Technical Documentation

Precision Integration Sound Level Meter Type 2236

United States Version

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Precision Integrating Sound Level Meter

Type 2236 A–007
Type 2236 B–007
Type 2236 C–007
Type 2236 D–007

From serial no. 1733094

October 1993

Brüel & Kjær

BB0907–12

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Chapter 1

Useful Information

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1.1 About this Manual

Figures are used to guide you through using the pushkeys. Please note the following when using the figures:

n× Press this pushkey n times

OK Press this to save any changes made in connection with the Settings or ⟨**Data**⟩ pushkeys

NO Press this to return to the screen indicated without saving any changes made

1.2 About the Type 2236 Sound Level Meter

1.2.1 Parameters

Precision Integrating Sound Level Meter Type 2236 is a Type 1 sound level meter complying with ANSI S 1.4–1983 and Draft S 1.43, 6th Sept., 1992, and IEC 651 (1979) and 804 (1985). It can measure the following parameters:

- `MaxL`: maximum SPL since the last reset
- `MinL`: minimum SPL since the last reset
- `MaxP`: maximum Peak level since the last reset
- `Peak`: maximum Peak level in 1s interval
- `SPL`: maximum RMS level in 1s interval (according to IEC 651)
- `Leq`: equivalent continuous sound level (L_{eq} according to IEC 804)
- `LIm`: equivalent continuous impulse sound level (if time weighting is I) (L_{Im} according to IEC 804, Appendix B)
- `LAV4`: equivalent continuous sound level with Exchange Rate of 4dB ($L_{AV,4}$ according to ANSI S 1.25, L_{DOD})*

* Not available with I time weighting

- LAV5: equivalent continuous sound level with Exchange Rate of 5 dB ($L_{AV,5}$ according to ANSI S 1.25, L_{OSHA})*
- SEL: Sound Exposure Level (if A-weighted, then = L_{EA}, according to IEC 804)
- IEL: Impulse Sound Exposure Level (if time weighting is I)
- LEPd: Daily Personal Noise Exposure Level (see section 8.3)†
- LN(3) (default L_{90}): RMS level exceeded N_3% of the measurement time (L_{N3})**
- LN(2) (default L_{50}): RMS level exceeded N_2% of the measurement time (L_{N2})**
- LN(1) (default L_{10}): RMS level exceeded N_1% of the measurement time (L_{N1})**
- Ovl: Input signal overloading instrument (% of the measurement time)

In addition, Precision Integrating Sound Level Meter Types 2236 C–007 and 2236 D–007 contain 1/1-octave filter sets between 31.5 Hz and 8 kHz which comply with ANSI S 1.11–1986 and IEC 225 (1966). They can measure all the above-mentioned parameters in each of the filter bands.

1.2.2 Settings

Checking and Changing the Settings

The sound level meter's Settings are additional to the basic measurement set-up. They are very useful and are based on a very simple principle (see the example in Fig. 1.1). There are twelve of them in all:

- Auto Logging
- Calibration
- Peak Weighting

* Not available with I time weighting
† Not available with I time weighting or Exchange Rate of 4 or 5 dB
** Not available with I time weighting

- Exchange Rate
- Date and Time
- Auto Start
- Change Range Reset
- Contrast
- Percentiles
- Exposure Time
- Interface
- Output Formats

Checking

You can check the first of the sound level meter's Settings by pressing ⟨**Show**⟩. You can then step through them by pressing ⟨**Show**⟩. However, the Settings are cyclic and you can step forwards and backwards through them using **Parameter** ⟨▲⟩ and ⟨▼⟩, respectively (see Fig. 1.1).

Changing

When you reach a Setting you want to change, press **Edit**. A cursor (▶) appears on the first set-up line you can change. If there are other set-up lines on the screen, you can move the cursor to them using **Level** ⟨▲⟩ and ⟨▼⟩.

When the cursor is on the set-up line of the Setting you want to change, press **Parameter** ⟨▲⟩ and ⟨▼⟩ to step through the available parameters. You can also step through them by pressing ⟨**Edit**⟩ (see Fig. 1.1).

When you have the set-up you desire for that Setting, press ⟨**OK**⟩ to save the changes and check the changed Setting. An accept cursor (■) briefly replaces the edit cursor (▶) to show that the sound level meter has accepted the change.

If you change a Setting by mistake, press ⟨**NO**⟩ instead of ⟨**OK**⟩ to revert to its previous set-up.

Fig. 1.2 shows an overview of the available Settings.

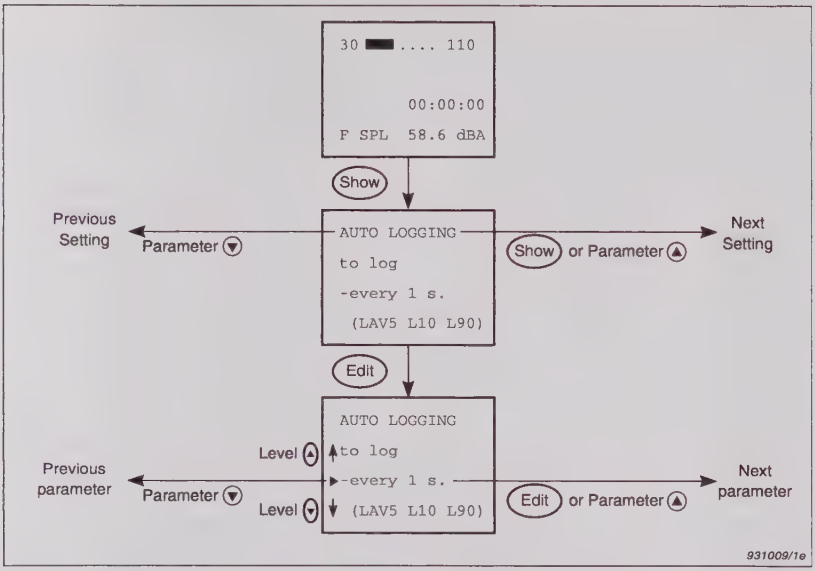

Fig. 1.1 Principle of checking and changing the sound level meter's Settings

Fast Edit

In addition to the normal way of changing the set-up of a Setting (i.e. pressing ⟨**Show**⟩, stepping through to the desired Setting and pressing ⟨**Edit**⟩), you can also use two pushkeys together to "fast edit" a Setting (i.e. go directly to a Setting with the edit cursor).

If you press ⟨**Edit**⟩ followed by the pushkey indicated in Table 1.1*, the selected Setting appears with the edit cursor (▶). You can now check and change the set-up of the Setting as described earlier in this section. When you have finished changing the Setting, pressing ⟨**NO**⟩ or ⟨**OK**⟩, however, returns you to the main screen.

* You must press the pushkey within 3s of pressing ⟨**Edit**⟩ for the fast edit function to work.

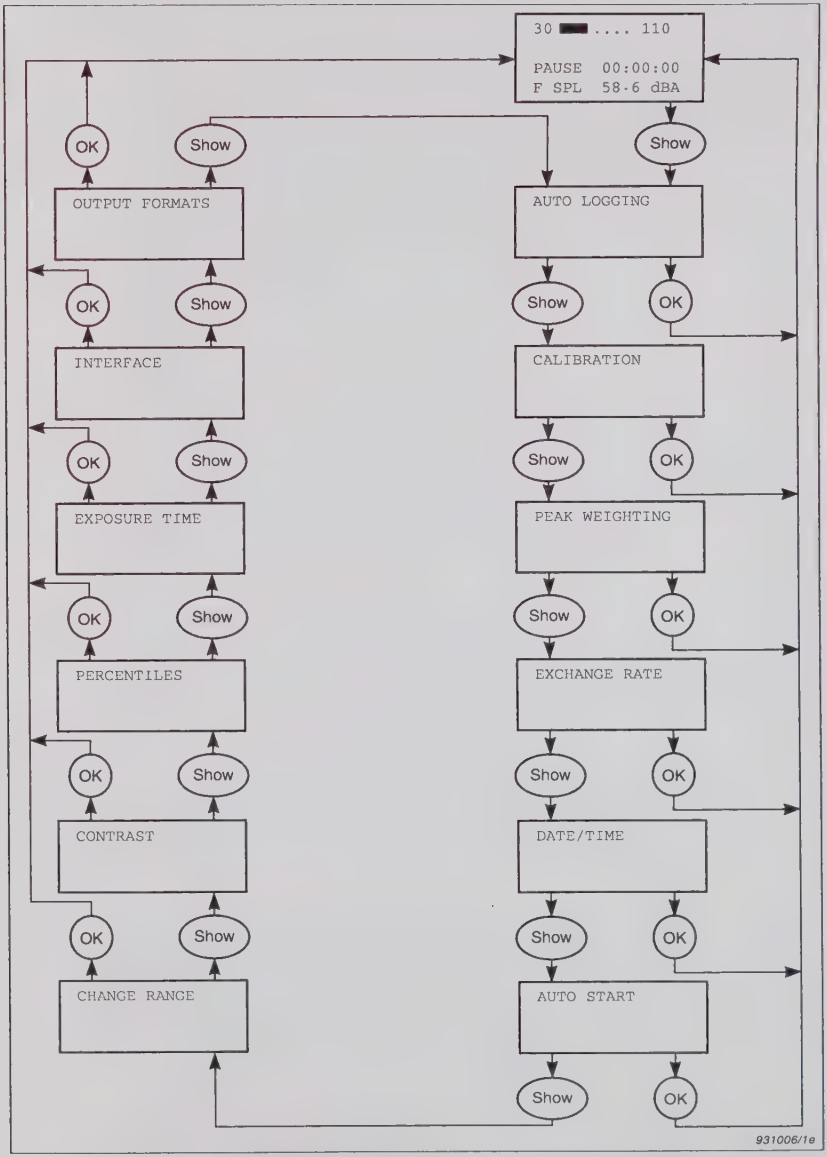

Fig. 1.2 An overview of the sound level meter's Settings

Fast Edit Pushkey (Edit +) ...	... Goes to Setting
Level ▲ or ▼	Calibration
Parameter ▲ or ▼ (Disp. param.: Peak, MaxP)	Peak Frequency Weighting
Parameter ▲ or ▼ (Disp. param.: L_{eq}, $L_{AV,4}$, $L_{AV,5}$)	Exchange Rate
⏲	Change Range with Reset
☼	Contrast
Parameter ▲ or ▼ (Disp. param.: L_N)	Percentiles
Parameter ▲ or ▼ (Disp. param.: $L_{EP,d}$)	Exposure Time
Data	Output Formats
⏲%	Auto Start
OK	Status (only via Fast Edit)

Table 1.1 Fast edit pushkeys and the Settings accessed

1.2.3 Data Operations

The sound level meter's ⟨**Data**⟩ pushkey allows you to print your measurement results (data) and control the sound level meter's memory. It operates on a similar principle as Settings (see section 1.2.2) except that you press ⟨**Data**⟩ instead of ⟨**Show**⟩. In addition, the sound level meter returns to the main screen after you have accepted changes to the selected operation. There are four data operations, each with its own screen:

- Print
- Store
- Recall
- Erase

Fig. 1.3 shows an overview of the data operations.

1.2.4 Memory

The sound level meter has three types of memory:

- Buffer
- Log

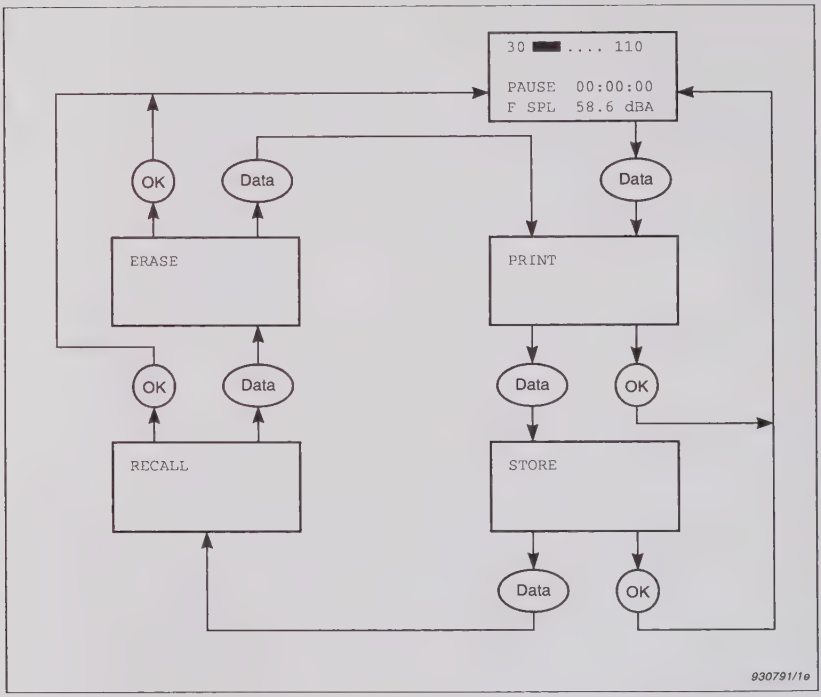

Fig. 1.3 An overview of the data operations available via the Data push-key

- Memory

Buffer

Contains the set-up and all results for the current measurement (i.e. since the last reset) – see section 1.2.1. From these, the cumulative and level distributions and the Overall Results are calculated. The buffer is updated once a second.

Log

Contains the automatically Logged Results (see section 5.5.2):

- L_{eq} ($L_{AV,4}$ or $L_{AV,5}$ when the Exchange Rate is 4 or 5dB, respectively)
- L_{10}
- L_{90}
- measurement time of results

Precision Integrating Sound Level Meter Types 2236 A–007 and C–007 can contain up to 21600 sets of results (i.e. up to 64800 results with their measurement times). This is enough to log, for example, 6hours of $L_{AV,5}$, L_{10} and L_{90} values logged every second.

Precision Integrating Sound Level Meter Types 2236 B–007 and D–007 can contain up to 86400 sets of results (i.e. up to 259200 results with their measurement times). This is enough to log, for example, 24hours of $L_{AV,5}$, L_{10} and L_{90} values logged every second.

Memory

Contains the Overall Results which you have manually stored in a Record together with the set-up. Can contain up to 40 Records.

Overall Results consist of:

- MaxL
- MinL
- MaxP
- L_{eq} (or $L_{AV,4}$, $L_{AV,5}$ or L_{Im})
- SEL (or IEL)
- $L_{EP,d}$
- Exposure Time
- Ovl
- L_{N1} (default L_{10})
- L_{N2} (default L_{50})
- L_{N3} (default L_{90})
- Frequency weighting of RMS signal
- Frequency weighting of Peak signal
- Time weighting
- Measurement range
- Elapsed measurement time
- Start date and time of measurement
- Number of pauses during measurement

Note: The three L_Ns in Overall Results are fixed as the selected L_Ns when the results were stored. You can, therefore, only see these three L_N values after recalling Overall Results.

1.3 Practical Hints

The sound level meter is designed as a self-contained unit to meet the requirements given in IEC 651 and similar national standards. However, some of the requirements given in the standards are based on measurements of pure tones under free field conditions. Practical measurements under similar conditions require the following extra precautions:

- do not stand close to the sound level meter
- do not use a windscreen or protective cover
- increase the distance between the microphone and the tripod (e.g. by using Tripod Arm UA 1246)
- using a microphone extension cable, increase the distance between the microphone and any objects which can cause disturbances

The influence of your presence on the measurement can easily be checked by changing the distance between you and the microphone and observing the change in the measured sound pressure level. If your position influences the measurement result, then use a microphone extension cable or spatially average your measurements. Note that, when dealing with pure tones, a small change in the position of the microphone can influence the result just as much as your physical presence.

Fortunately, the combination of free sound field and pure tones is very rare. With sound coming from several directions and as you are measuring over a broad frequency band, the influence of the sound level meter's housing, tripod and user becomes insignificant, and the above precautions need not be taken.

Figs. 6.8 and 6.9 show the influence of Tripod UA 0801 and Protective Cover UA 1236 under free field conditions and with pure tones.

Chapter 2

An Example Measurement

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2.1 Introduction

This chapter guides you through the basic functions of the sound level meter by instructing you on how to make a noise measurement in a free sound field according to ISO 1996. You can find further information on the various steps in the relevant sections of the User Manual.

It is a good idea to have the fold out back cover open so that you have an annotated illustration of the sound level meter in front of you while you follow the example measurement.

We have assumed that the sound level meter is switched off and has not been used before following these instructions. If it has, ensure that you are using the default set-up (see section 3.3) before following the steps below.

We have also assumed that you will calibrate the sound level meter with Sound Level Calibrator Type 4231 and that you will print out your results using Serial Printer WQ 1138.

2.2 Making a Measurement

Turning On

1. Press ⏻.

   The sound level meter turns on. After a self-test, the sound level meter is set up in Pause mode in the default set-up. The quasi-analogue scale shows the input signal to the preamplifier and the displayed parameter shows the current SPL. The buffer, log and memory are empty.

   Since the displayed parameter (SPL) is an RMS parameter, you can see the frequency weighting of the RMS signal (shown in the bottom right-hand corner of the screen). See the fold out back cover for more details of the main screen.

Calibrating the Sound Level Meter

2. Press ⟨**Show**⟩.

   The screen shows the default Auto Logging screen.

3. Press **Parameter** ⟨▲⟩.

   The screen changes to the Calibration screen.

4. Press **Edit**.

   The screen shows the calibration set-up (see Fig. 2.1).

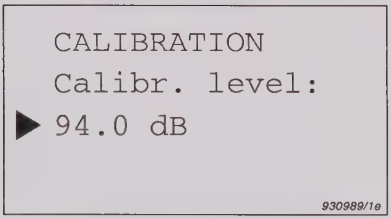

Fig. 2.1 The calibration set-up screen

5. Read the correct calibration level from the calibrator's calibration chart and use **Parameter** ⟨▲⟩ and ⟨▼⟩ to set the sound level meter to this level.*

6. Fit the calibrator onto the sound level meter and rest the sound level meter on a table or other flat surface. Ensure that the calibrator fits snugly on the microphone.

7. Switch on the calibrator.

   The calibrator emits the 1kHz calibration signal.

8. Press ⟨**OK**⟩.

* Sound Level Calibrator Type 4231 provides a nominal calibration signal of 94dB at 1kHz. However, each calibrator is slightly different. It is, therefore, important to set the calibration level to the one given on the calibration chart for the calibrator used.

The sound level meter checks the calibration signal against the calibration level you set in step 5. It then asks if you want to calibrate according to the expected level.

9. Press ⟨**OK**⟩.

   The sound level meter calibrates itself according to the calibration level you set in step 5 and returns to the Calibration screen.

10. Press ⟨**OK**⟩.

    The sound level meter returns to the main screen.

Checking the Weightings

11. Press ⟨**Frequency Wt.**⟩ three times.

    The frequency weighting of the RMS signal (displayed in the bottom right-hand corner of the screen) changes through the three available weightings.

12. Press ⟨**F/S/I**⟩ three times.

    The time weighting displayed in the bottom left-hand corner of the screen changes through the three available weightings.

Setting up the Sound Level Meter to Log

13. Press ⟨**Show**⟩.

    The screen shows the default Auto Logging screen (see Fig. 2.2). You can see that the sound level meter is set up so that it doesn't store Logged Results in its log.

14. Press ⟨**Edit**⟩ .

    You can now set up the sound level meter to automatically store Logged Results in its log.

15. Press **Parameter** ⟨▲⟩.

    The screen changes to the Auto Logging set-up screen shown in Fig. 2.3. You can see that the sound level meter

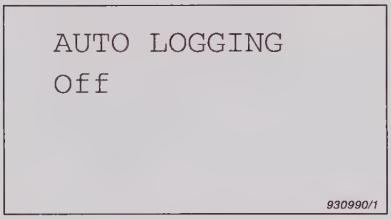

Fig.2.2 The default Auto Logging set-up screen

is set up to automatically store Logged Results ($L_{AV,5}$, L_{10} and L_{90}) in its log every 1s.

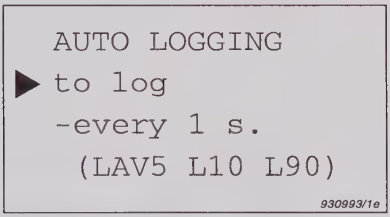

Fig.2.3 One of the Auto Logging set-up screens

16. Press ⟨**OK**⟩ twice.

    The sound level meter returns to the main screen.

    You are now ready to start an A-weighted measurement of noise with a FAST time weighting. $L_{AV,5}$, L_{10} and L_{90} will be automatically logged into the sound level meter's log.

Measuring

17. Select an appropriate measurement range using **Level** ⟨▲⟩ or ⟨▼⟩.

    An appropriate measurement range is when the signal remains on the quasi-analogue scale at all times and no

overload (indicated by + in the upper right-hand corner of the screen) occurs.

Note: It is important to select an appropriate measurement range before starting to measure as, if you change the range, either the sound level meter will reset, or the distributions and L_Ns will not be available.

18. Press ⊜.

    This clears the sound level meter's buffer of results and sets the elapsed time to zero.

19. Press ⊘.

    The sound level meter starts measuring. The timer on the right-hand side of the screen starts counting the elapsed measurement time. The A-weighted SPL is shown at the bottom of the screen. After each second, $L_{AV,5}$, L_{10} and L_{90} are transferred to the sound level meter's log.

20. Use **Parameter** ⟨▲⟩ or ⟨▼⟩ to look at the various parameters available.

    The quasi-analogue scale always shows the SPL, regardless of the selected parameter. Note that, when a Peak parameter is selected, the frequency weighting of the Peak signal is shown. Note also that, when changing the parameter, the sound level meter does not reset.

21. After a few minutes, press ⊘.

    The sound level meter stops measuring and logging. The timer shows the total measurement time.

Checking the Sound Level Meter's Calibration

22. Press ⟨**Show**⟩.

    The screen shows the default Auto Logging screen.

23. Press **Parameter** ⟨▲⟩.

    The screen changes to the Calibration screen.

24. Press ⟨**Edit**⟩.

    The screen shows the calibration set-up from before the measurement.

25. Fit the calibrator onto the sound level meter and rest the sound level meter on a table or other flat surface. Ensure that the calibrator fits snugly on the microphone.

26. Switch on the calibrator.

    The calibrator emits the 1kHz calibration signal.

27. Press ⟨**OK**⟩.

    The sound level meter checks the calibration signal against the calibration level you set in step 5. They should be the same. If they are not, note the difference for inclusion in your measurement report.

28. Press ⟨**NO**⟩ twice.

    The sound level meter returns to the Calibration screen and then to the main screen without being recalibrated.

Storing Results in the Sound Level Meter's Memory

29. Press ⟨**Data**⟩.

    The first Data screen (Print Set-up) appears.

30. Press **Parameter** ⟨▲⟩.

    The Store Set-up screen (see Fig. 2.4) appears.

31. Press ⟨**OK**⟩.

    The Overall Results of the measurement you have just made are stored as Record No. 1 in the sound level meter's memory.

Printing out Overall Results

Warning! When connecting the sound level meter to the printer, ensure that both the printer and the sound level

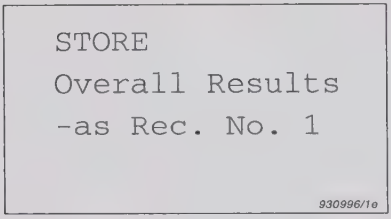

Fig. 2.4 The Store Set-up screen

meter are switched off. Otherwise the instruments could be damaged.

32. Switch the sound level meter off and connect it to Serial Printer WQ 1138 via the **Serial Interface** socket on the base of the sound level meter using 9-pole Cable with 25-pole Adaptor AO 1386.

33. Switch the sound level meter on.

34. Hold down the printer's ⟨**On Line**⟩ pushkey and switch the printer on.

    The printer prints its set-up.

35. Ensure that the printer's baud rate is 9600 (see the printer's instruction manual for details on how to change its baud rate).

    The sound level meter is set, by default, to output the overall results with a short heading at a baud rate of 9600. To get a print-out, the printer and the sound level meter must have the same baud rate.

36. Press ⟨**Data**⟩.

    The Print Set-up screen appears (see Fig. 2.5).

37. Press ⟨**OK**⟩.

    The printer prints the Overall Results (see section 1.2.4) together with a short heading containing the measure-

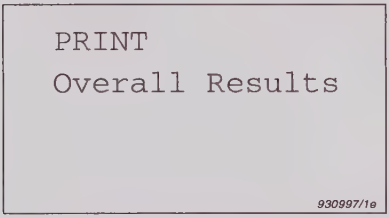

Fig.2.5 The default Print Set-up screen

ment set-up (the frequency weightings of the RMS and Peak signals, the time weighting and the measurement range). After transferring the results to the printer, the sound level meter displays the main screen.

Chapter 3

Setting Up the SLM for Measurement

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3.1 Mounting the Microphone

Before mounting the microphone, note the following precautions:

- When screwing in the microphone, input stage, protection grid and extension cables, **do it gently** to avoid damaging the threads
- Keep dust and foreign objects off the microphone diaphragm. Do not touch the diaphragm with any object — it is very delicate.

Mounting the Microphone

1. Gently screw Microphone Type 4188 (supplied with the sound level meter) onto Input Stage ZC0025.

2. Insert the input stage into the input stage socket and secure by turning the threaded retaining ring (see Fig. 3.1).

Connecting the Microphone Extension Cable

1. Gently screw Microphone Type 4188 (supplied with the sound level meter) onto Input Stage ZC0025.

2. Insert the input stage into Microphone Extension Cable AO0408 (3m) or AO0409 (10m).

3. Insert the other end of the microphone extension cable into the input stage socket and secure by turning the threaded retaining ring (see Fig. 3.2).

Note: Connecting a recommended microphone extension cable has no effect on the sound level meter's calibration. Therefore, you do not have to recalibrate after connecting one of the recommended microphone extension cables.

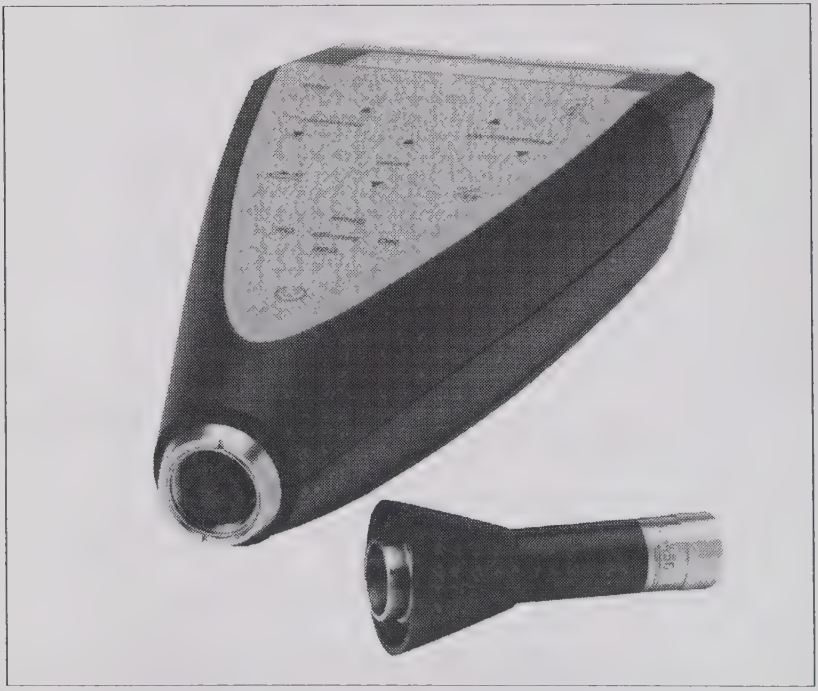


Fig. 3.1 Mounting the input stage and microphone onto the sound level meter

3.2 Fitting Batteries

3.2.1 Replacing Batteries

1. Press the two tabs on the upper edge of the battery compartment and remove the lid.

2. Replace the old batteries with new ones (four 1.5V LR6/ AA size alkaline batteries) as shown in the battery compartment and press the compartment lid back into place.

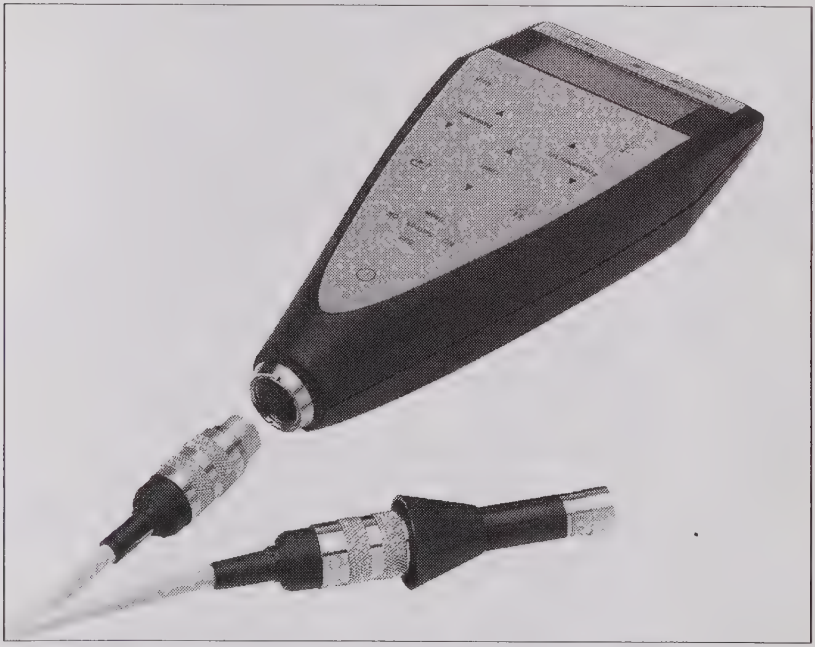


Fig. 3.2 Connecting a microphone extension cable to the sound level meter

Note: If you cannot turn on the sound level meter after replacing the batteries, check that they are correctly inserted. The sound level meter is designed so that it will not work if the batteries are wrongly inserted in the battery compartment.

Warnings!

It is possible for batteries to explode or leak if they are handled incorrectly, so:

- For long-term storage, remove the batteries and keep the sound level meter in a dry place.
- Never mix different makes or types of battery.
- Never mix charged and discharged batteries.

- Always label the outside of the battery compartment with the type of batteries contained.

3.2.2 Using an External Power Supply

The sound level meter can be powered from a regulated or smoothed 7–15V DC supply via the **External Power** socket on the base (e.g. from the mains supply via an adaptor).

You can connect the external power supply even when the batteries are installed. The sound level meter automatically selects the source with the highest supply voltage. The external power supply will not damage the batteries but neither will it recharge the batteries.

3.2.3 The Back-up Battery

The sound level meter has a back-up battery for running the clock and maintaining the memory, log and buffer, even when the sound level meter is switched off or the main batteries are removed.

The back-up battery is automatically recharged when there are batteries in the sound level meter. It is fully charged after about 10hours. Fully charged, the back-up battery runs the clock and retains the results for about 6months.

These times are typical for alkaline batteries in a sound level meter at room temperature.

If the back-up battery is flat, the date and time will be reset to a factory set date. If you find that the date and time are wrong, this is probably the reason.

3.3 Turning the SLM On and Off

Turning the Sound Level Meter On

Press ⏻.

The sound level meter tests its memory and then returns to Pause mode with the set-up it had when it was last switched off. While testing its memory, the display shows the version of the sound level meter (e.g. 2236 A–007).

The default set-up is:

Frequency weighting (RMS):	A
Frequency weighting (Peak):	C
Time weighting:	F
Displayed parameter:	SPL
Displayed range:	30 – 110dB
Baud rate:	9600
Output formats:	Overall Results Short Heading Logged Results Short Heading Printer Level Distribution Short Heading 5dB resolution Cumulative Distribution Short Heading 5dB resolution
L_{N1}:	L_{10}
L_{N2}:	L_{50}
L_{N3}:	L_{90}
Auto logging:	Off
Exposure Time:	7:30 hours
Exchange Rate:	5dB
Reset at range change:	On
Auto start:	Off

Note: To turn the sound level meter on in the default set-up, press and hold ⊖ and then press ⏻. The sound level

meter erases all results in the buffer and returns to the default set-up in Pause mode.

Note: To erase all results in the log, memory and buffer, press ⏎ and ⟨**Data**⟩.

Turning the Sound Level Meter Off

Press ⏻.

The sound level meter goes into Pause mode and switches off. No measurement data from the buffer, log and memory is lost.

3.4 Setting the Measurement Range

The measurement range is shown to the left and right of the quasi-analogue scale. Sound level meters without filter sets (Types 2236 A–007 and 2236 B–007) have 5 measurement ranges each with a dynamic range of 80dB. Sound level meters with filter sets (Types 2236 C–007 and 2236 D–007) have an extra measurement range from 10 to 90dB:

- 10 – 90dB*
- 20 – 100dB
- 30 – 110dB
- 40 – 120dB
- 50 – 130dB
- 60 – 140dB

* Only available with sound level meters with filter sets (Types 2236 C–007 and 2236 D–007) and when the filter is selected.

931018/1e

To move the measurement range by 10dB, press **Level** ⟨▲⟩ or ⟨▼⟩, respectively.†

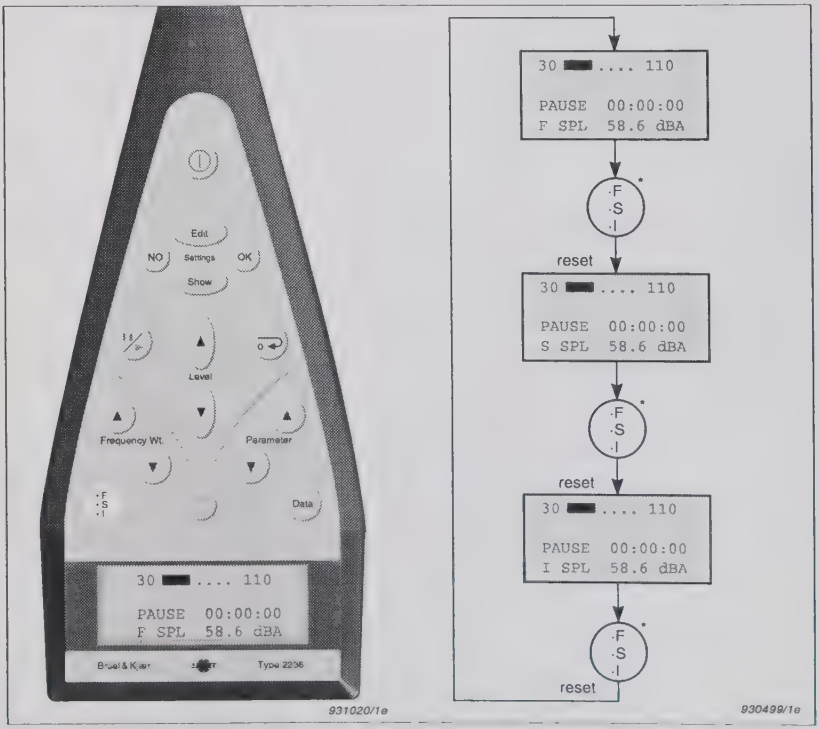
If you have selected a measurement range that is too low, the signal will cause an overload. If the sound level meter is currently overloaded, a + is shown to the right of the quasi-analogue scale. If the sound level meter has been overloaded since the last reset, OVL is shown at the right-hand side of the screen, under the quasi-analogue scale.

† You can set the sound level meter to reset when changing the measurement range (see section 3.11). Then, if there are more than 1min. of measurement results in the buffer (i.e. the elapsed time shown is greater than 1min.), the screen tells you that changing the measurement range will erase all previous measurement results from the buffer.
If you do not want to erase the measurement results, press ⟨**NO**⟩. The measurement range will not change.
Press ⟨**OK**⟩ to change the range and erase the measurement results.

3.5 Setting the Time Weighting

The time weightings available are shown below:

F: for normal measurements
S: for checking average levels of fluctuating noise
I: for measuring impulsive noise



The display shows N.A. if you select a time weighting which is not available with the current displayed parameter or Exchange Rate.

* If there are more than 1 min. of measurement results in the buffer (i.e. the elapsed time shown is greater than 1 min.), the screen tells you that changing the time weighting will erase all previous measurement results from the buffer.
If you do not want to erase the measurement results, press ⟨**NO**⟩.
Press ⟨**OK**⟩ to change the time weighting and erase the measurement results.

Note: If results are being logged every 0.1 s, the sound level meter sets the time weighting to 5 ms (shown on the display by q). You cannot change the time weighting until you change the logging set-up (see section 3.12).

3.6 Setting the Frequency Weighting

3.6.1 Introduction

If the selected parameter is Peak or MaxP, then the frequency weighting of the Peak signal is shown. Otherwise, the frequency weighting of the RMS signal is shown. Therefore, the frequency weighting shown always corresponds to the selected parameter.

3.6.2 Setting the RMS Frequency Weighting

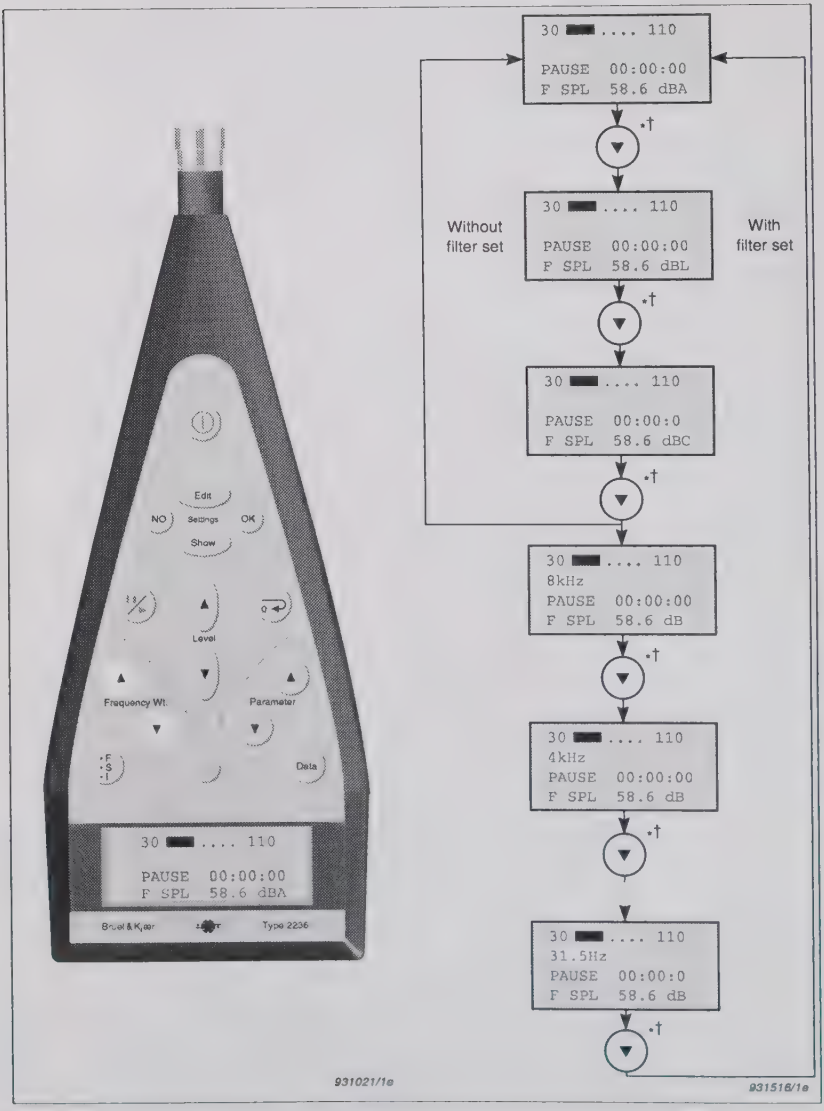
The available frequency weightings of the RMS signal are shown below:

A: for general sound level measurements
C: for checking the low-frequency content of a noise (if the C-weighted level is much higher than the A-weighted level, then there is a large amount of low-frequency noise)
L: for determining the "unweighted" SPL
XHz: (with filters) for measuring the frequency content of a noise in order to choose, for example, the relevant hearing protection

---

* If there are more than 1 min. of measurement results in the buffer (i.e. the elapsed time shown is greater than 1 min.), the screen tells you that changing the frequency weighting will erase all previous measurement results from the buffer.
If you do not want to erase the measurement results, press ⟨**NO**⟩.
Press ⟨**OK**⟩ to change the frequency weighting and erase the measurement results.

† Press **Frequency Wt.** ⟨▲⟩ to change the frequency weighting in the opposite direction to **Frequency Wt.** ⟨▼⟩.

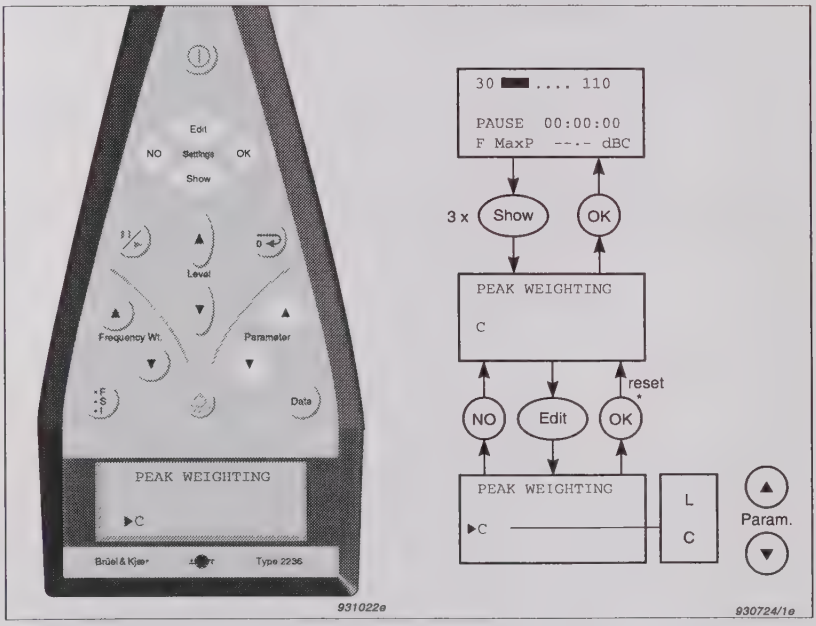


* See footnote on previous page.
† See footnote on previous page.

3.6.3 Setting the Peak Frequency Weighting

The available frequency weightings of the Peak signal are shown below:

C: for measuring the damaging effects of noise
L: for special applications



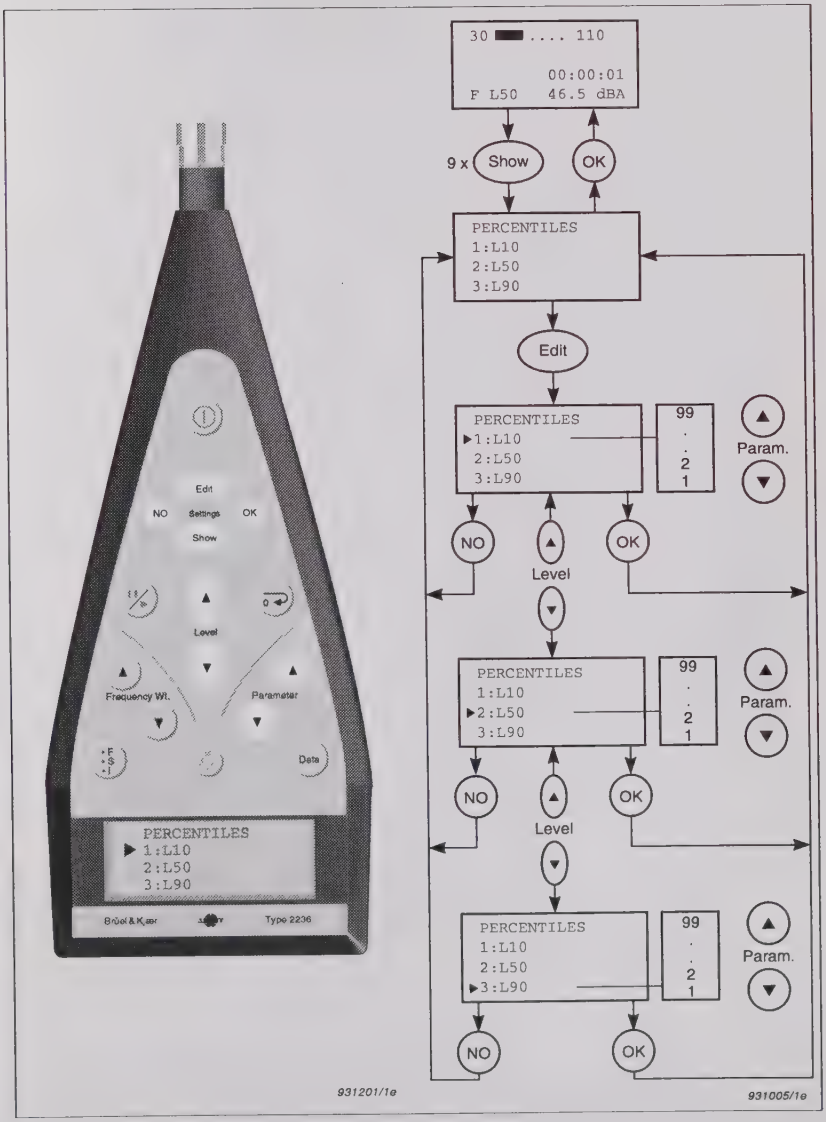
* If there are more than 1 min. of measurement results in the buffer (i.e. the elapsed time shown is greater than 1 min.), the screen tells you that changing the frequency weighting will erase all previous measurement results from the buffer.
If you do not want to erase the measurement results, press **NO**.
Press **OK** to change the frequency weighting and erase the measurement results.

3.7 Setting the Percentiles

Three L_N parameters (percentile levels) are transferred over the interface to a printer or computer (see sections 5.6 and 5.7) with Overall Results. You can choose three percentiles or use the default percentiles L_{10}, L_{50} and L_{90}. The selected percentiles can also be displayed one after another on the display (see section 4.8). N can have values of between 1 and 99 in integer (1) steps.

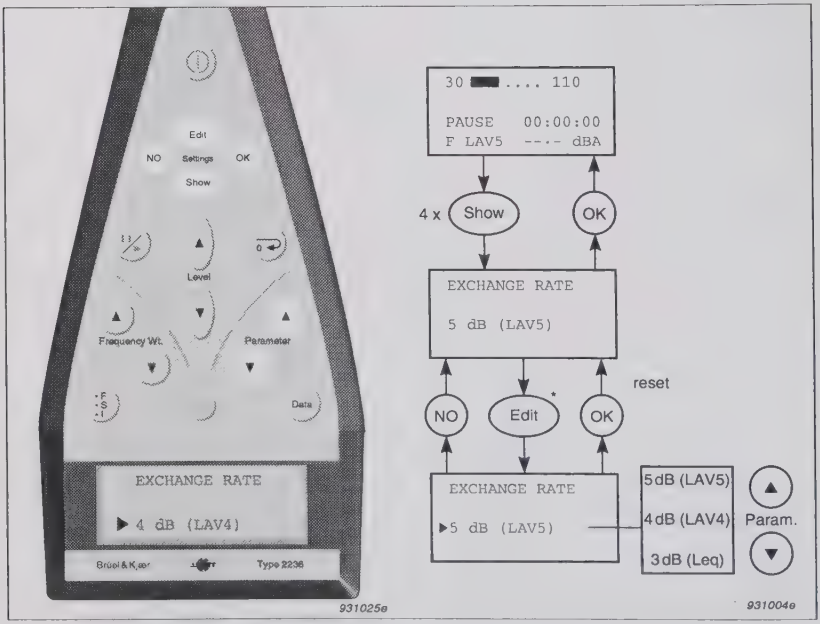
Note:

- Changing the percentiles does not reset the sound level meter. Therefore, you can view any percentile levels during or after a measurement.
- The sound level meter always logs L_{10} and L_{90} in Logged Results, regardless of the selected percentiles.


30 110
00:00:01
F L50 46.5 dBA
9 x
Show
OK
PERCENTILES
1:L10
2:L50
3:L90
Edit
PERCENTILES
▶1:L10
2:L50
3:L90
99
2
1
Param.
NO
Level
OK
PERCENTILES
1:L10
▶2:L50
3:L90
PERCENTILES
1:L10
2:L50
▶3:L90
Edit
NO
Settings
OK
Show
Level
Frequency Wt.
Parameter
Data
Brüel & Kjær
Type 2236
931201/1e
931005/1e

3.8 Setting the Exchange Rate

Exchange Rate is described in section 8.1.



The display shows N.A. if you select an Exchange Rate which is not available with the current time weighting.

The current Exchange Rate line also indicates which L_{AV} parameter is currently selected (see Table 3.1). If the Exchange Rate is 3dB, $L_{EP,d}$ (see section 8.3) is also calculated by the sound level meter.

---

* If there are more than 1min. of measurement results in the buffer (i.e. the elapsed time shown is greater than 1min.), the screen tells you that changing the Exchange Rate will erase all previous measurement results from the buffer.
If you do not want to erase the measurement results, press ⟨**NO**⟩.
Press ⟨**OK**⟩ to change the Exchange Rate and erase the measurement results.

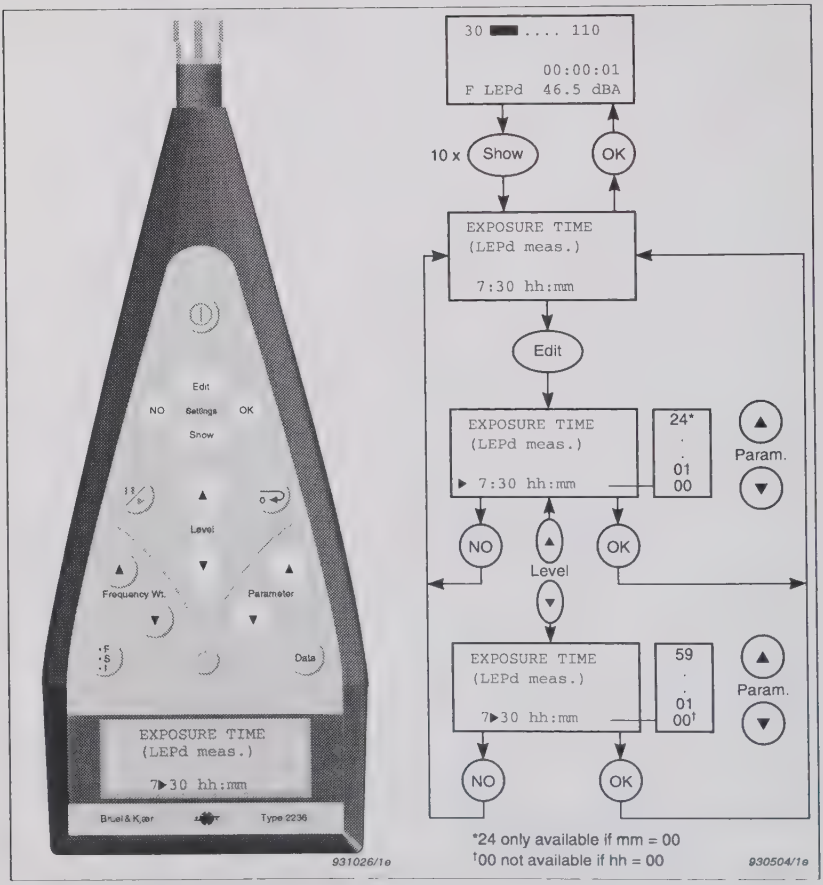
Exchange Rate (dB)	L_{AV} Parameter
3	L_{eq}
4	$L_{AV,4}$ (L_{DOD})
5	$L_{AV,5}$ (L_{OSHA})

Table 3.1 The L_{AV} parameter measured and displayed is dependent on the Exchange Rate

3.9 Setting the Exposure Time

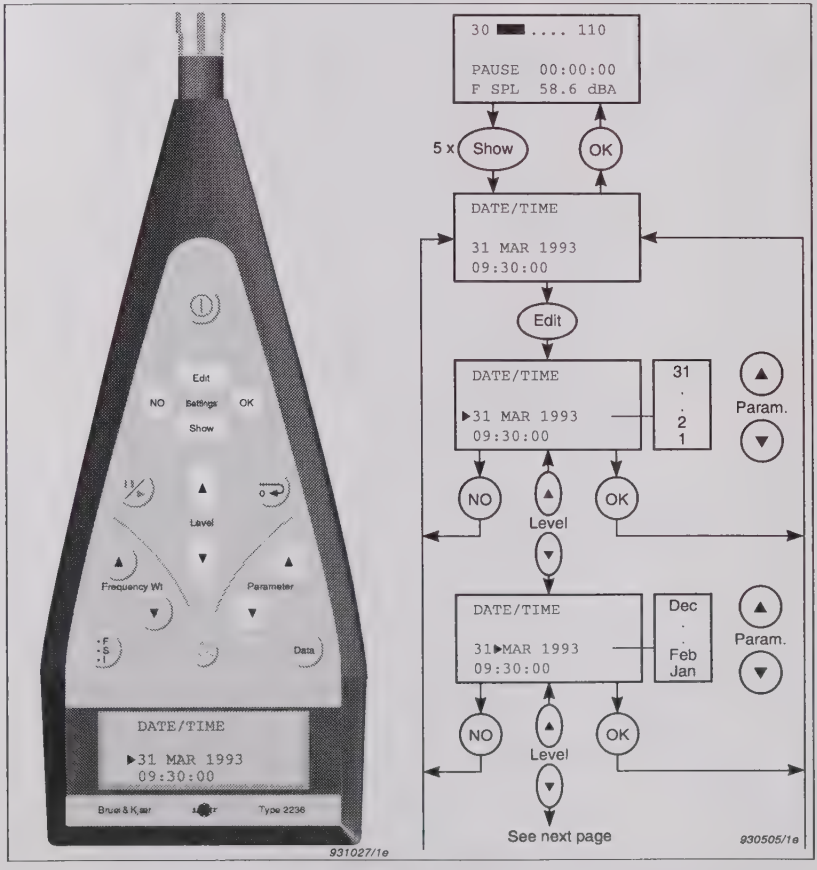
Exposure Time is used in the calculation of $L_{EP,d}$ (see section 8.3). It can have values of between 1min. and 24hours.

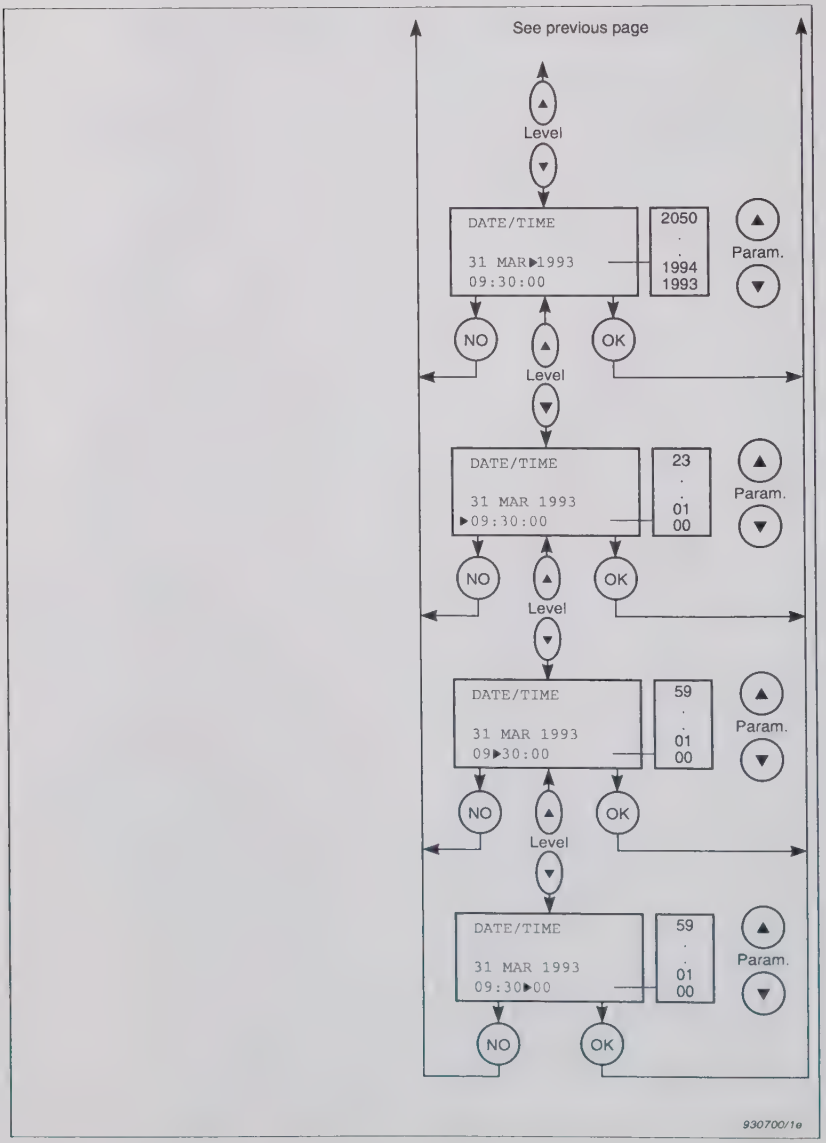
Note: Changing the Exposure Time does not reset the sound level meter. Therefore, you can investigate the effect of different Exposure Times on the $L_{EP,d}$ after a measurement.


Edit
NO
Settings
OK
Show
Level
Frequency Wt.
Parameter
Data
EXPOSURE TIME
(LEPd meas.)
7▶30 hh:mm
Brüel & Kjær
Type 2236
931026/1e
30 110
00:00:01
F LEPd 46.5 dBA
10 x
Show
OK
EXPOSURE TIME
(LEPd meas.)
7:30 hh:mm
Edit
EXPOSURE TIME
(LEPd meas.)
▶ 7:30 hh:mm
24*
01
00
Param.
NO
Level
OK
EXPOSURE TIME
(LEPd meas.)
7▶30 hh:mm
59
01
00†
Param.
NO
OK
*24 only available if mm = 00
†00 not available if hh = 00
930504/1e

3.10 Setting the Date and Time

The sound level meter's clock operates, even when the sound level meter is switched off, if the internal back-up battery is charged up (see section 3.2.3). It is factory set to Central European Time (GMT+1).

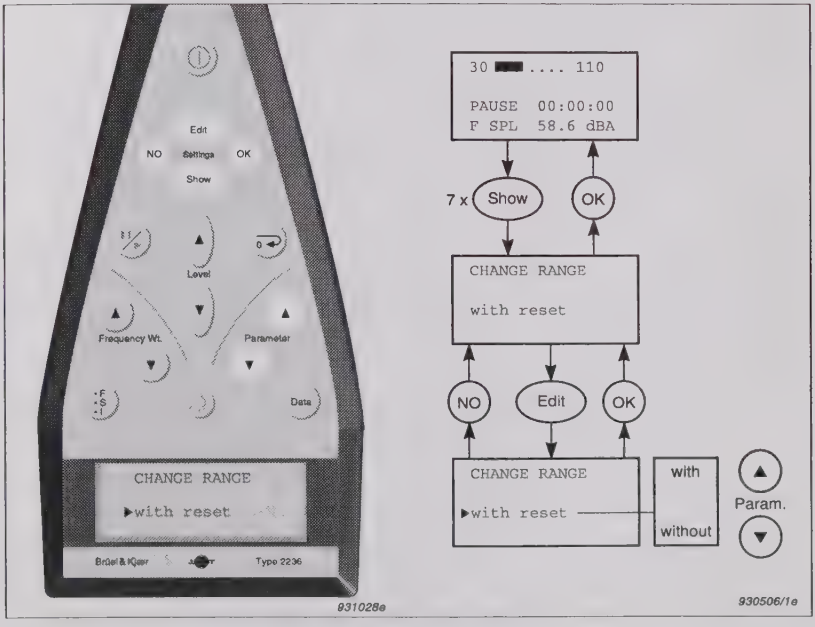



See previous page
Level
DATE/TIME
31 MAR▶1993
09:30:00
2050
.
.
1994
1993
Param.
NO
Level
OK
DATE/TIME
31 MAR 1993
▶09:30:00
23
.
.
01
00
Param.
NO
Level
OK
DATE/TIME
31 MAR 1993
09▶30:00
59
.
.
01
00
Param.
NO
Level
OK
DATE/TIME
31 MAR 1993
09:30▶00
59
.
.
01
00
Param.
NO
OK
930700/1e

3.11 Setting the SLM to Change Range without Resetting

The sound level meter always resets when changing frequency or time weighting, Exchange Rate or date and time. The sound level meter also normally resets when changing the measurement range.

As an option, you can set the sound level meter to change measurement range without resetting. If you do this and change the range, the distributions and L_N parameters will not be available (N.A. will be shown on the display if an L_N is selected).



Note: If an overload has occurred, the results are not correct. You can, however, accept them (for example, if the overload

was of relatively short duration). If the sound level meter is set to not reset when changing the measurement range, you will be unable to see from the Overall Results at which measurement range the overloads took place. You can, however, see when they took place in the Logged Results.

3.12 Setting up Auto Logging

You can set the sound level meter to automatically log:

- L_{eq} ($L_{AV,4}$ or $L_{AV,5}$ when the Exchange Rate is 4 or 5dB, respectively)
- L_{10}
- L_{90}
- measurement time of results

and store them at regular intervals in its log or send them via the **Serial Interface** to a PC. The logging time (i.e. the amount of time between each set of results) can be one of the following:

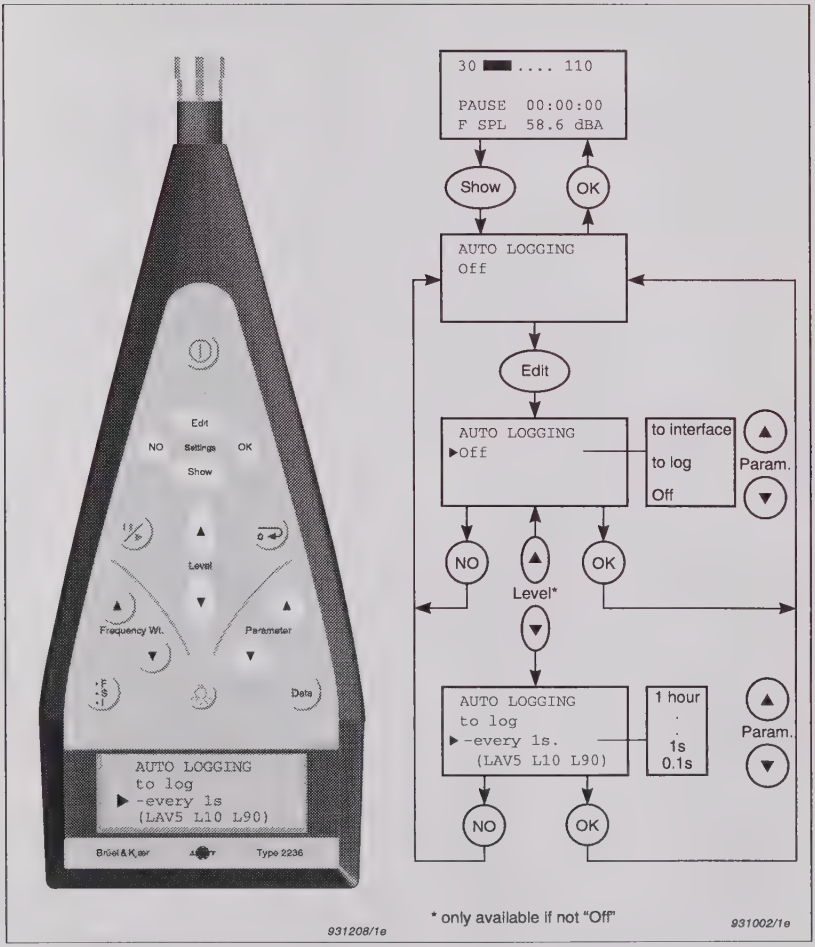
- 0.1s*
- 1s
- 10s
- 1min.
- 10min.
- 30min.
- 1hour

The sound level meter always resets when changing frequency or time weighting or Exchange Rate.

Results are not logged while the sound level meter is in Pause mode.

Pressing ⓒ does not erase the log. To erase the log, see section 5.3.

* Only L_{eq} is logged. The sound level meter sets the time weighting to 5ms (shown on the display by ⊐). You cannot change the time weighting.


AUTO LOGGING
to log
▶ -every 1s
(LAV5 L10 L90)
Brüel & Kjær
Type 2236
Edit
NO
Settings
OK
Show
Level
Frequency Wt.
Parameter
Data
931208/1e
30 110
PAUSE 00:00:00
F SPL 58.6 dBA
Show
OK
AUTO LOGGING
Off
Edit
AUTO LOGGING
▶Off
to interface
to log
Off
Param.
NO
Level*
OK
AUTO LOGGING
to log
▶ -every 1s.
(LAV5 L10 L90)
1 hour
1s
0.1s
Param.
NO
OK
* only available if not "Off"
931002/1e

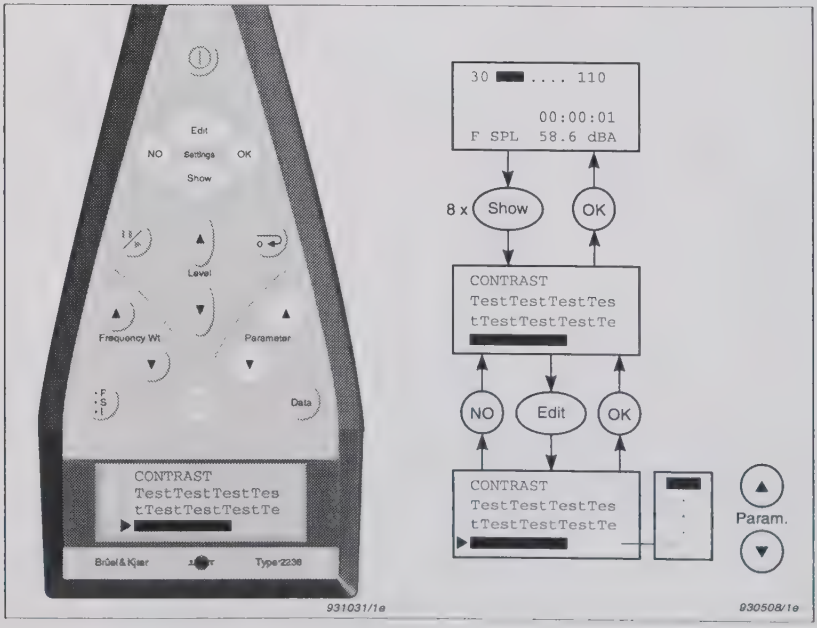
3.13 Setting the Viewing Conditions

The sound level meter's screen can be changed to cope with various lighting conditions and viewing angles. You can switch on a back-light and adjust the screen's contrast.

To switch the back-light on, press ⓐ.

The back-light switches off automatically 30s after the last key press. To switch the back-light off before this, press ⓐ.

To set the contrast of the screen, follow the instructions below:



Chapter 4

Measuring

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Checking the Sound Level Meter's Calibration ..... 4 – 5

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4.3 Starting a New Measurement ..... 4 – 7

4.4 Pausing a Measurement ..... 4 – 9

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4.1 Calibrating

4.1.1 Introduction

When to Calibrate

The standards recommend that you calibrate your sound level meter before each set of measurements (see section 4.1.2) and check the calibration after each set (see section 4.1.3).

Connecting a recommended microphone extension cable has no effect on the sound level meter's calibration. Therefore, you do not have to recalibrate after connecting one of the recommended microphone extension cables.

Principle of Calibration

The sound level meter first checks the calibration signal against a calibration level you set. Then the sound level meter shows you the difference, if any, between the level you set and the level it measured, and asks if you want to recalibrate. If you press ⟨**OK**⟩, the sound level meter calibrates itself according to this calibration level (i.e. it adjusts itself to read the entered calibration level).

Calibrating for Free Field or Diffuse Field Measurements

The sound level meter is calibrated in the same way for free field measurements (according to IEC) and diffuse field measurements (according to ANSI). However, the calibration levels for some calibrators may be different, depending on which measurements are to be made. See the calibrator's user manual for more details.

Always remove the Random Incidence Corrector DZ9566 (if fitted) from the microphone when calibrating or checking the calibration.

Which Calibrators Can I Use?

The sound level meter can be calibrated with Sound Level Calibrator Type 4231, Multifunction Acoustic Calibrator Type

4226 or a similar calibrator. All are referred to on the sound level meter's display as the calibrator.

Each calibrator is slightly different. The actual calibration level is not necessarily equal to the nominal calibration level. It is, therefore, important to set the calibration level to the one given on the calibration chart for the calibrator used.

4.1.2 Calibrating the Sound Level Meter

Sound Level Calibrator Type 4231 provides a nominal pressure field calibration signal of 94 or 114dB at 1kHz. The nominal diffuse field calibration signal is also 94 or 114 dB but the nominal free field calibration signal is 93.8 or 113.8 dB.

Multifunction Acoustic Calibrator Type 4226 provides a nominal calibration signal of 94, 104 or 114dB at a range of frequencies.

For day to day calibration, you only need to calibrate at one level at one frequency. In order to comply with the standards, calibrate the sound level meter with a reference signal of 94dB at 1kHz*.

To calibrate:

1. Fit the calibrator carefully onto the sound level meter and rest the sound level meter on a table or other flat surface. Ensure that the calibrator fits snugly on the microphone (see Fig. 4.1).

2. For the multifunction acoustic calibrator, set it up to calibrate at 94dB and 1kHz (see the calibrator's instruction manual).

3. Switch on the calibrator.

   The calibrator emits a 1kHz calibration signal.

* Calibration at other frequencies requires correction for the frequency weighting used (see Chapter 6).

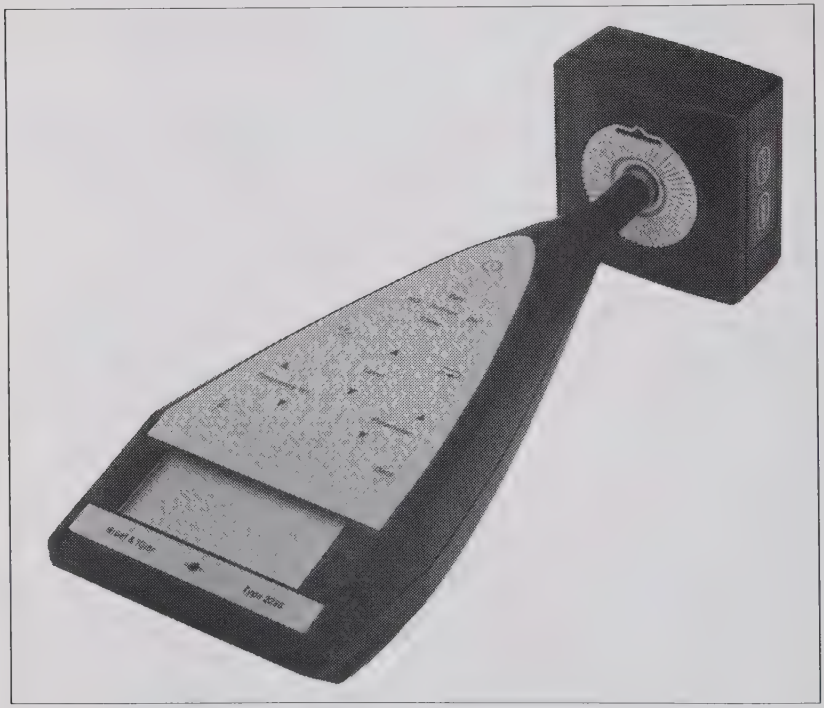
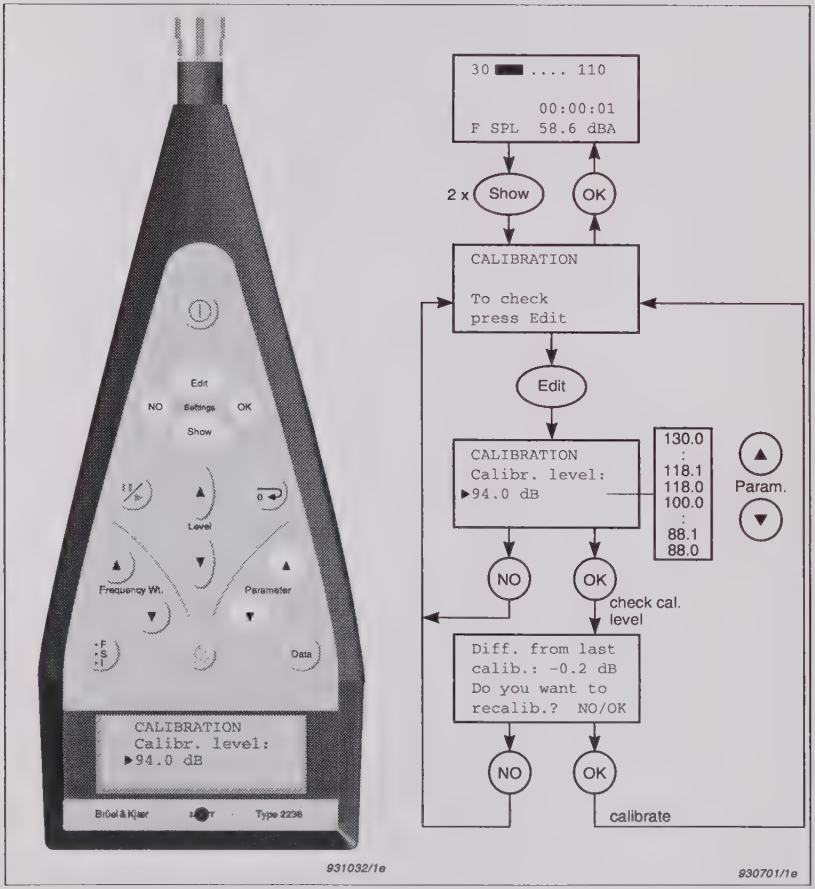


Fig. 4.1 Fitting Sound Level Calibrator Type 4231 onto the sound level meter. Multifunction Acoustic Calibrator Type 4226 is fitted in a similar way (see its manual)

4. Follow the instructions given in the figure below to calibrate to the relevant level for the type of measurements to be made*:

* For Sound Level Calibrator Type 4231, 94 dB for diffuse field or 93.8 dB for free field. For Multifunction Acoustic Calibrator Type 4226, 94 dB for both diffuse and free field.



4.1.3 Checking the Sound Level Meter's Calibration

Follow the instructions given in section 4.1.2 until the sound level meter asks whether you want to recalibrate or not. Press ⟨**NO**⟩ twice to return to the main screen.

4.2 Checking the Sound Level Meter

Before you start a longer series of measurements, it is good practice to check the status of the sound level meter's battery, log and memory. To do this, press ⟨**Edit**⟩ and ⟨**OK**⟩. The sound level meter shows the status screen. Press ⟨**OK**⟩ to return to the sound level meter's main screen.

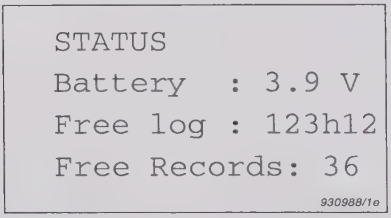


Fig. 4.2 The sound level meter's status screen

Battery:
With fresh batteries, the status screen will show approximately 6V. When there is about half an hour's operation left (when there is approximately 4V), the battery voltage level flashes ("3.9V" will flash in the example shown in Fig. 4.2)*. The length of time fresh batteries last depends on the conditions of use (temperature, use of the back-light, etc.). Fresh alkaline batteries in a sound level meter without a filter set (Type 2236 A–007 or 2236 B–007) will take over 12 hours to wear out. Those in a sound level meter with a filter set (Type 2236 C–007 or 2236 D–007) will take over 10 hours to wear out.

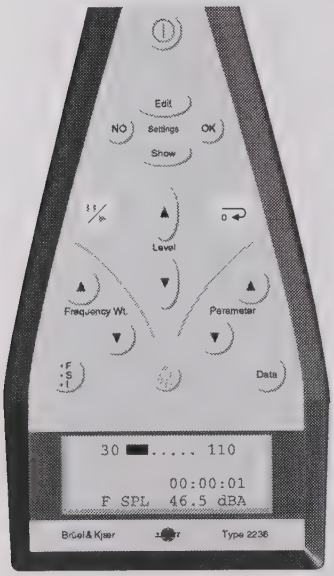
Note: The battery voltage will normally be higher just after the sound level meter is switched on. Therefore, always wait a minute or so before checking the battery status.

Free log:
The hours and minutes left in the log at the current rate of logging are shown.

* The main screen also shows a battery low warning (see Fold Out).

Free Records:
The number of empty Records left in the memory is also shown.

4.3 Starting a New Measurement *



931033/1e

1. Calibrate the sound level meter as described in section 4.1.

2. Select a suitable measurement range.

   This reduces the risk of you having to change the range during a measurement in order to avoid Overloads. Overloads reduce the validity of your results and changing the measurement range may cause a reset.

3. Press ⏎.

If there are more than 1min. of measurement results in the sound level meter's buffer (i.e. the elapsed time shown on the screen is greater than 1min.), the screen tells you that resetting will erase all previous measurement results from the buffer. If this occurs, press ⟨**OK**⟩ to confirm that you want to reset the sound level meter.

* If you are only interested in instantaneous parameters (i.e. Peak or SPL), you can miss out steps 3 and 5

The results in the sound level meter's display buffer are erased and the elapsed time is set to zero. The overload hold is reset so that the sound level meter indicates that there have not been any overloads since the last reset.

Note: To erase all results in the Log, Memory and display buffer, press ⏎ and ⟨**Data**⟩.

4. If you want to measure according to IEC standards (i.e. free field), simply point the sound level meter towards the sound source.

   If you want to measure according to ANSI standards (i.e. diffuse field), fit the supplied Random Incidence Corrector DZ9566 on the microphone. The direction of the sound level meter is unimportant. If, however, the sound field is free, measure with the sound level meter at an angle of between 70 and 80° to the sound source.

5. Press ½.

   The sound level meter starts measuring with the selected set-up.

Note:

- When mounting the sound level meter on a tripod, position the tripod so that one of its legs points in the same direction as the sound level meter. This will reduce the risk of damaging the microphone if the tripod is accidentally knocked over.
- See section 1.3 for practical hints and information about measuring according to standards.

4.4 Pausing a Measurement

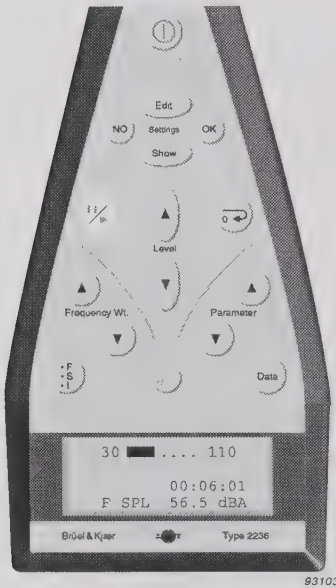
931034/1e

The Pause mode of the sound level meter allows you to store results in its memory or transfer results across the interface to a printer or computer.

Press %.

PAUSE is shown on the left-hand side of the display. The clock stops counting the measurement time. The display and quasi-analogue scale continue to show the current status of the displayed parameter and input signal level, respectively. In Pause mode, however, no results are added to the buffer or the log.

4.5 Continuing a Measurement

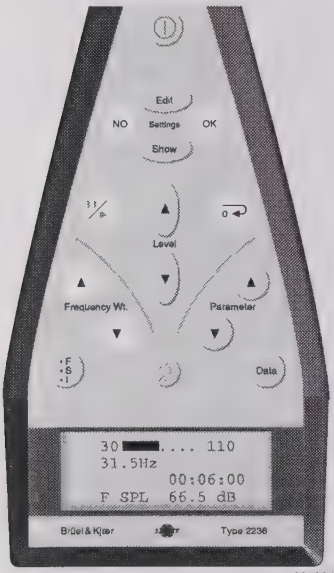


931035e

Press ⏸.

PAUSE disappears from the display. The clock continues counting the measurement time from the point at which it stopped. Results are added to the buffer and, if selected, the log.

4.6 Starting a Frequency Analysis*



931684/1e

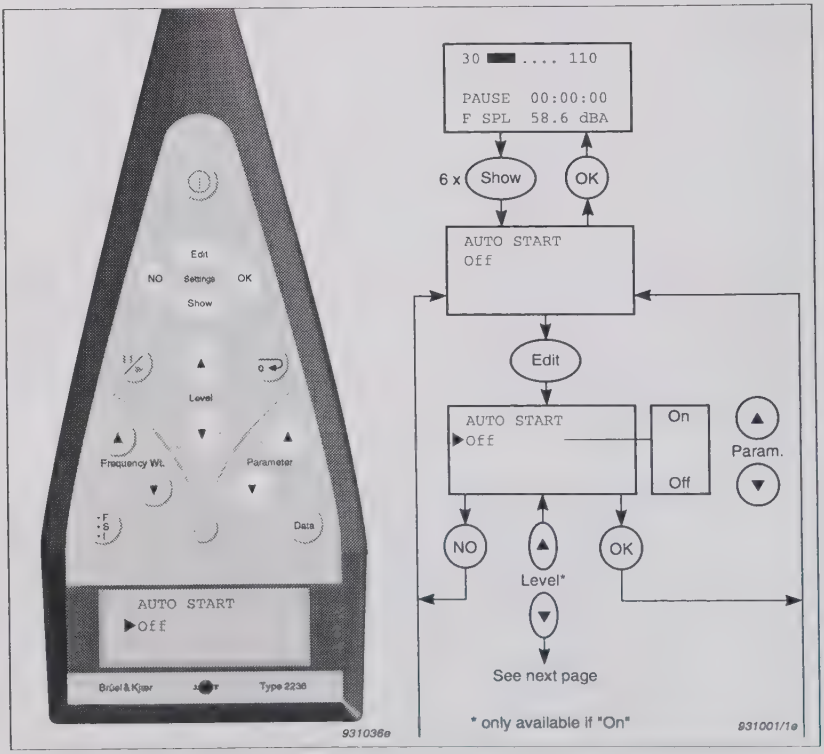
1. Using **Frequency Wt.** ⟨▲⟩ or ⟨▼⟩, change the frequency weighting to the centre frequency of the band in which you want to start the analysis (see section 3.6.2).
2. Press ⊛.
3. Press ⊛.
4. After you have completed the measurement in that frequency band, press ⊛.
5. Store the Overall Results in the Memory (see section 5.1).
6. Using **Frequency Wt.** ⟨▲⟩ or ⟨▼⟩, change the frequency weighting to the centre frequency of the band in which you want to continue the analysis.

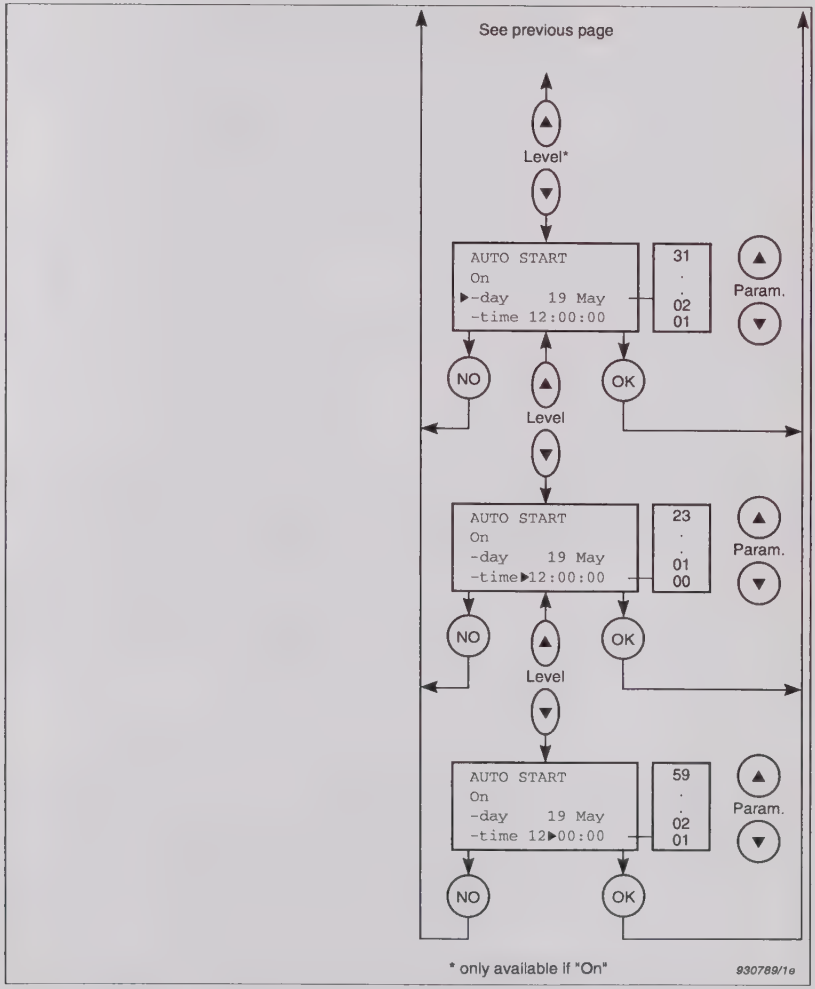
   The sound level meter resets. You are now ready to measure in the next frequency band.
7. Repeat steps 3 to 6 for the other bands in which you want to analyze.

* Only available with sound level meters with filter sets (Types 2236 C–007 and 2236 D–007)

4.7 Setting the SLM to Start Automatically

The sound level meter can be set to automatically start at any time and date within the next month (e.g. from 19th May to 18th June).




See previous page
Level*
AUTO START
On
▶-day 19 May
-time 12:00:00
31
02
01
Param.
NO
Level
OK
AUTO START
On
-day 19 May
-time▶12:00:00
23
01
00
Param.
NO
Level
OK
AUTO START
On
-day 19 May
-time 12▶00:00
59
02
01
Param.
NO
OK
* only available if "On"
930789/1e

Auto Start only works if the sound level meter is switched off at the set time. Then, at this time, the sound level meter will turn on, reset and, after a pause of 5 seconds, start measuring with the set-up it had when it was switched off.

Once the sound level meter has started measuring, you can control it in the normal way.

If the sound level meter is already switched on at the time it has been set to automatically start measuring, Auto Start has no effect.

After the set time has been passed, Auto Start is switched off to prevent the sound level meter from repeating an automatic measurement every month.

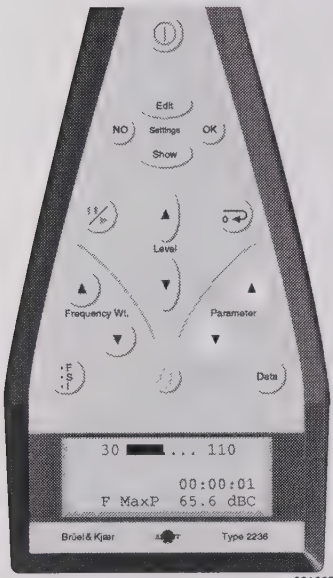
Auto Start does not affect your use of the sound level meter while the sound level meter is switched on. Therefore, you can set the sound level meter to start measuring at a particular time and date while measuring without affecting your current measurement results.

4.8 Changing the Displayed Parameter

The parameters available are listed in section 1.2.1. The selected parameter and its level are shown at the bottom of the screen. After a reset, "–.–" is shown for the level until after the first second after a Pause. This is because the level is not available. The quasi-analogue scale always shows the current RMS input signal level, regardless of the selected parameter.

A DC level corresponding to the SPL is emitted from the **DC Output** socket at the base of the sound level meter for recording on a plotter. The signal emitted from the **AC Output** socket is unaffected by which parameter or frequency weighting is selected. It is always the L-weighted output from the preamplifier and is for recording noise signals on tape, trans-

ferring signals to an analyzer or listening to the input on headphones.



931037/1e

To step forwards and backwards through the available parameters, press **Parameter** ⟨▲⟩ or ⟨▼⟩, respectively.

When a Peak parameter is shown, the frequency weighting shows the current weighting of the Peak signal. When an RMS parameter is shown, the frequency weighting shows the current weighting of the RMS signal.

The display shows N.A. if you select a displayed parameter which is not available with the current time weighting or after changing the measurement range without resetting.

Chapter 5

Storing and Transferring Results

5.1 Storing Results in a Record ..... 5 – 2

5.2 Recalling Results from a Record ..... 5 – 3

5.3 Erasing Results ..... 5 – 4

5.4 Setting up the Interface ..... 5 – 5

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- Level Distribution ..... 5 – 14
- Cumulative Distribution ..... 5 – 15
- Checking and Changing the Output Formats ..... 5 – 16

5.6 Printing ..... 5 – 17

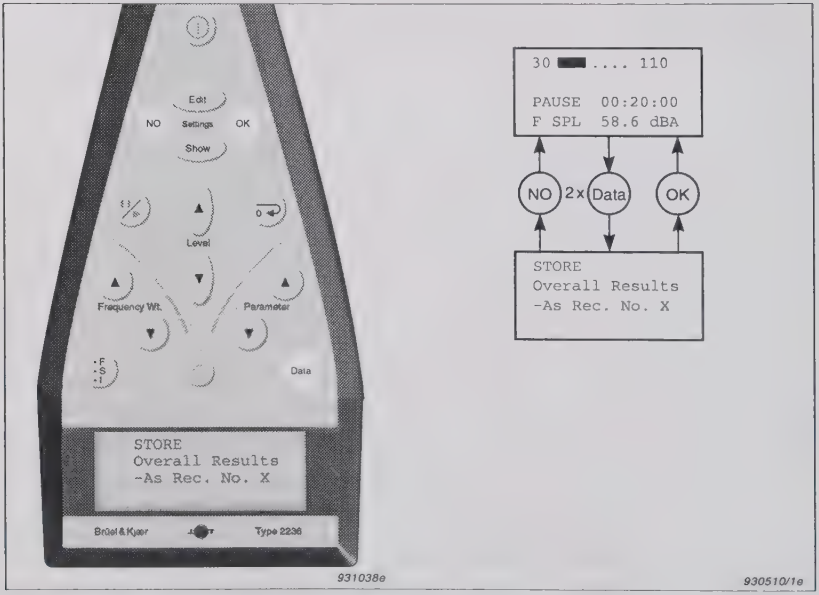
5.7 Transferring Results to a Computer ..... 5 – 20

5.8 Recording on a DAT-recorder ..... 5 – 23

5.1 Storing Results in a Record

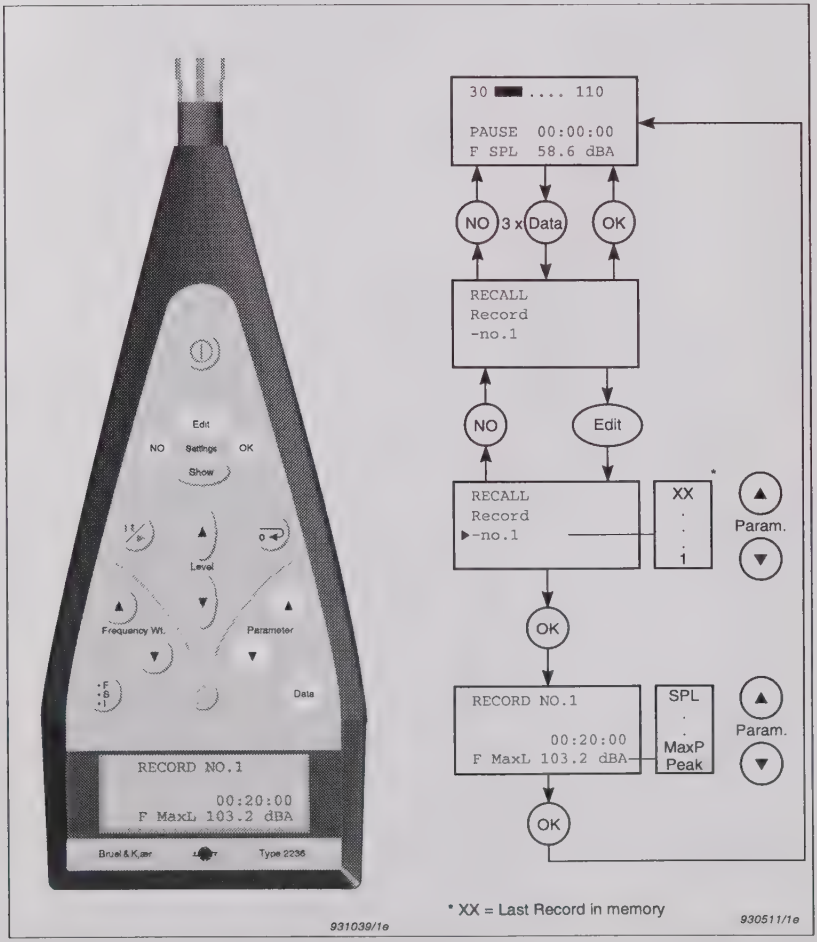
Results in the buffer can be stored as one of 40 Records in the sound level meter's memory. The results are stored in the first available Record (i.e. the first set of results in Record 1, the next set in Record 2, etc.).

Example: If you have stored 4 Records and then erased Record 2, the sound level meter will store the next set of results in Record 2. The next set of results will then be stored in the first available Record (i.e. Record 5).



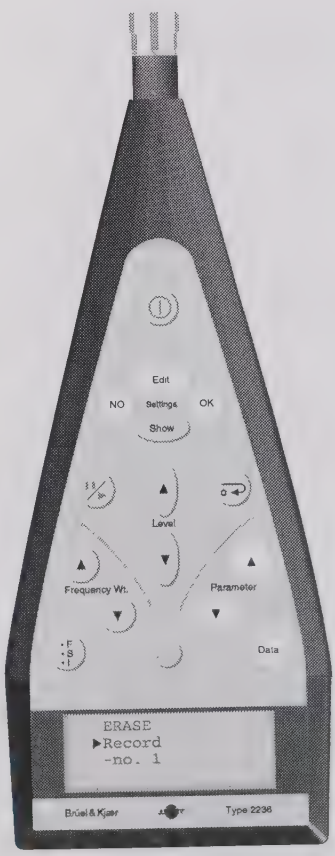
5.2 Recalling Results from a Record

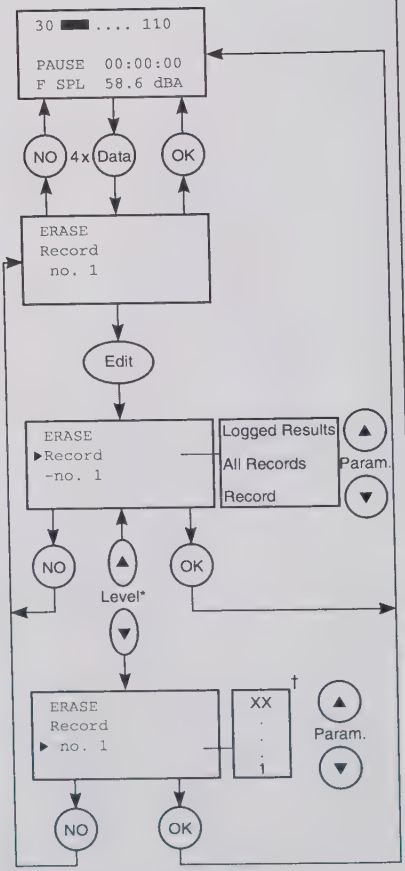
Results in a Record in the memory can be recalled to the sound level meter's buffer. You can then look at that Record's Overall Results.



5.3 Erasing Results

You can erase results from a single Record, all Records (i.e. the entire memory) or the log.





* only available when Record selected
† XX = last Record in memory

931040/1e 930512/1e

5.4 Setting up the Interface

The interfaces of the sound level meter and the instrument (e.g. printer or PC) it is connected to via the **Serial Interface** socket must be the same to enable them to communicate without losing or corrupting data.

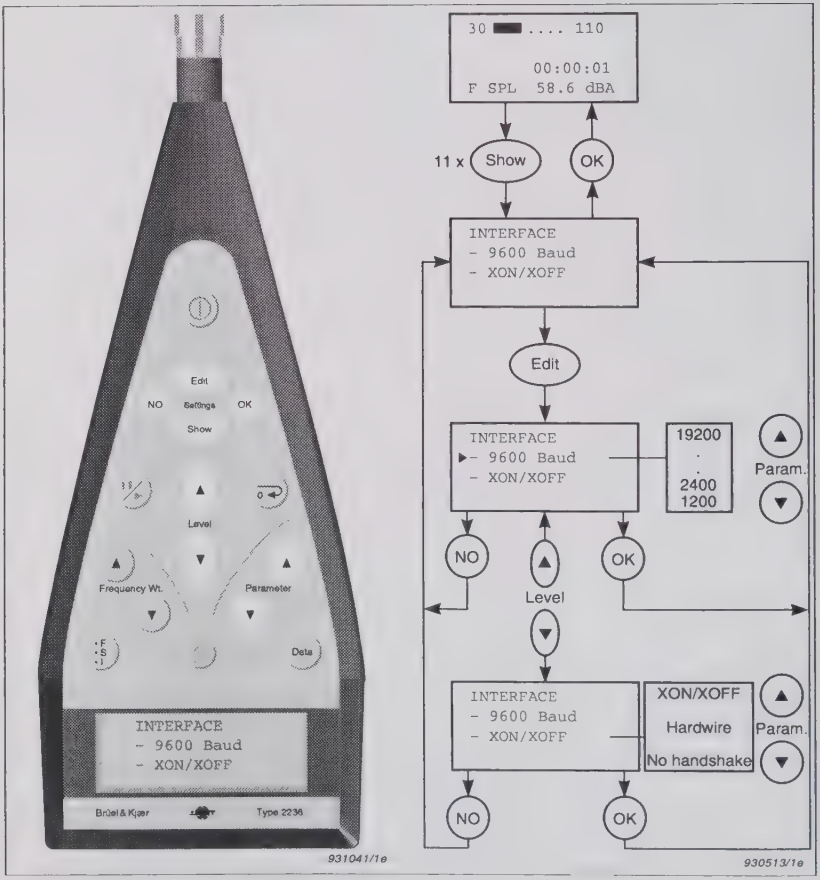
Both the handshake and baud rate of the sound level meter's interface can be set.

The following types of handshake are available:

- hardwire
- XON/XOFF
- none

The following baud rates are available:

- 1200
- 2400
- 4800
- 9600
- 19200


Edit
NO
Settings
OK
Show
Level
Frequency Wt.
Parameter
Data
INTERFACE
- 9600 Baud
- XON/XOFF
Brüel & Kjær
Type 2236
931041/1e
30 110
00:00:01
F SPL 58.6 dBA
11 x
Show
OK
INTERFACE
- 9600 Baud
- XON/XOFF
Edit
INTERFACE
▶- 9600 Baud
- XON/XOFF
19200
2400
1200
Param.
NO
Level
OK
INTERFACE
- 9600 Baud
- XON/XOFF
XON/XOFF
Hardwire
No handshake
Param.
NO
OK
930513/1e

5.5 Setting up the Output Formats

5.5.1 Introduction

The output formats determine how the results are transferred to a printer or computer. Each type of result has its own independent output format.

Results

The following results are available with short headings:

- Overall Results (see section 1.2.4)
- Logged Results (see section 1.2.4)
- Level Distribution
- Cumulative Distribution

Short Heading

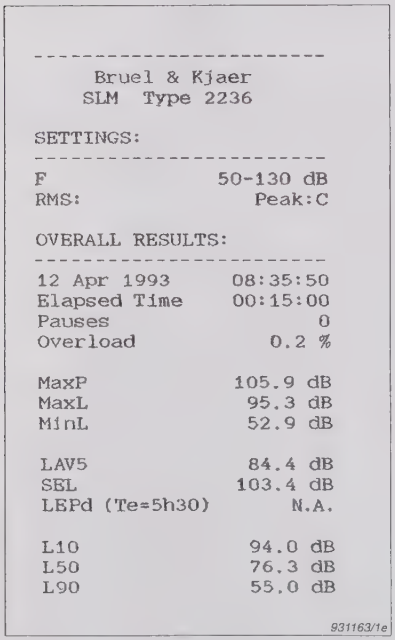


Fig. 5.1 Overall Results output format with a short heading

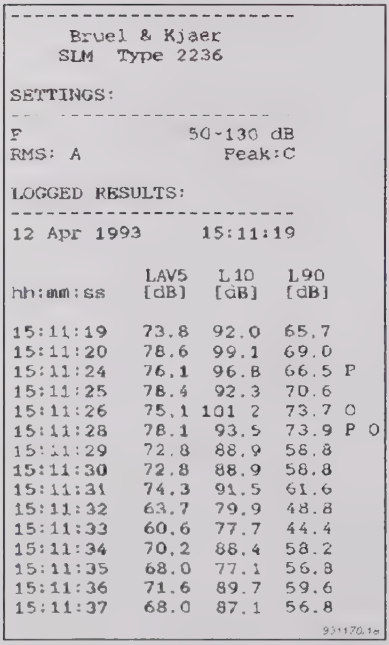
The set-up of the sound level meter in a short format together with the date and time of the start of the measurement. See Fig. 5.1 for an example of the Overall Results output format with a short heading.

5.5.2 Logged Results

The following 3 output formats are available for logged results:

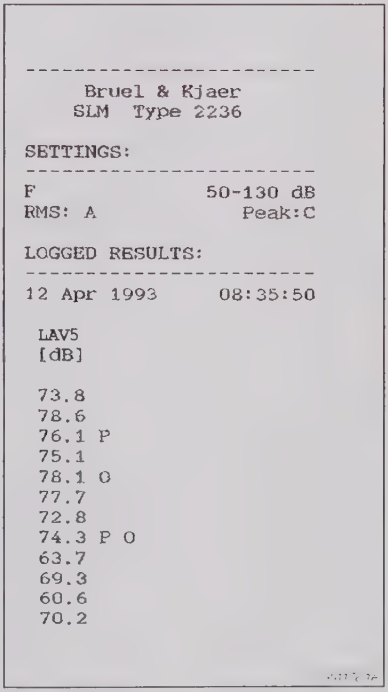
Printer

For use with an IBM® Proprinter or compatible serial printer (for example, Serial Printer WQ1138). The format is shown in Figs 5.2 and 5.3.



```
------------------------
     Bruel & Kjaer
    SLM  Type 2236

SETTINGS:
------------------------
F                50-130 dB
RMS: A              Peak:C

LOGGED RESULTS:
------------------------
12 Apr 1993      15:11:19

             LAV5   L10    L90
hh:mm:ss     [dB]   [dB]   [dB]

15:11:19    73.8   92.0   65.7
15:11:20    78.6   99.1   69.0
15:11:24    76.1   96.8   66.5 P
15:11:25    78.4   92.3   70.6
15:11:26    75.1  101.2   73.7 O
15:11:28    78.1   93.5   73.9 P O
15:11:29    72.8   88.9   58.8
15:11:30    72.8   88.9   58.8
15:11:31    74.3   91.5   61.6
15:11:32    63.7   79.9   48.8
15:11:33    60.6   77.7   44.4
15:11:34    70.2   88.4   58.2
15:11:35    68.0   77.1   56.8
15:11:36    71.6   89.7   59.6
15:11:37    68.0   87.1   56.8
```

Fig. 5.2 Printer output format with short heading (results logged every 1s)



```
------------------------
     Bruel & Kjaer
    SLM  Type 2236

SETTINGS:
------------------------
F                50-130 dB
RMS: A              Peak:C

LOGGED RESULTS:
------------------------
12 Apr 1993      08:35:50

 LAV5
 [dB]

 73.8
 78.6
 76.1 P
 75.1
 78.1 O
 77.7
 72.8
 74.3 P O
 63.7
 69.3
 60.6
 70.2
```

Fig. 5.3 Printer output format with short heading (results logged every 0.1s)

"P" indicates that there has been a pause during the logging.

"O" indicates that there has been an overload (OVL) during the logging period.

Printer (24 character/line)

For use with a Graphics Printer Type 2318 or other printers with line widths of 24 characters (see Fig. 5.4).

"P" indicates that there has been a pause during the logging.

"O" indicates that there has been an overload (OVL) during the logging period.

"&" indicates that there has been both a pause during the logging and an overload (OVL) during the logging period.

Printer (24 character/line) output format when results have been logged every 0.1s is the same as the Printer output format (see Fig. 5.3).

```
------------------------
     Bruel & Kjaer
    SLM  Type 2236

SETTINGS:
------------------------
F                 50-130 dB
RMS: A               Peak:C

LOGGED RESULTS:
------------------------
12 Apr 1993       15:11:19

          LAV5   L10   L90
hhmmss    [dB]   [dB]  [dB]

151119   73.8   82.0  65.7
151120   78.6   89.1  69.0
151124P  76.1   86.8  66.5
151125   78.4   92.3  72.6
151126O  75.1   91.2  73.7
151128&  78.1   93.5  73.9
151129   77.7   93.0  73.3
151130   77.7   93.0  73.3
151131   72.8   88.9  68.8
151132   74.3   91.5  71.6
151133   63.7   79.9  58.8
151134   69.3   83.8  63.1
151135   60.6   77.7  54.4
151136   70.2   88.4  68.2
151137   68.0   87.1  66.8
```

931173/1e

Fig.5.4 Printer (24 character/line) output format with short heading (results logged every 1s)

Spreadsheet

A comma-delimited format (i.e. all data are in inverted commas (") and are separated by commas) for use with spreadsheet programs (e.g. Excel).

```
"2236"
"12 Apr 1993"

"1"
"F"
"RMS:A","Peak:C"
"50-130 dB"

"Time","LAV5","L10","L90 ","Pause","Ovl"
"15:11:19",73.8,82.0,65.7
"15:11:20",78.6,89.1,69.0
"15:11:24",76.1,86.8,66.5,"P"
"15:11:25",78.4,92.3,70.6
"15:11:26",75.1,91.2,73.7,,"O"
"15:11:28",78.1,93.5,73.9,"P","O"
"15:11:30",72.8,88.9,68.8
"15:11:31",72.8,88.9,68.8
"15:11:32",74.3,91.5,71.6
"15:11:33",63.7,79.9,58.8
"15:11:34",70.2,88.4,68.2
"15:11:35",60.6,77.7,54.4
"15:11:36",70.2,88.4,68.2
"15:11:37",68.0,87.1,66.8
```

931176/1e

Fig. 5.5 Spreadsheet output format with short heading (results logged every 1s)

"P" indicates that there has been a pause during the logging.

"O" indicates that there has been an overload (OVL) during the logging period.

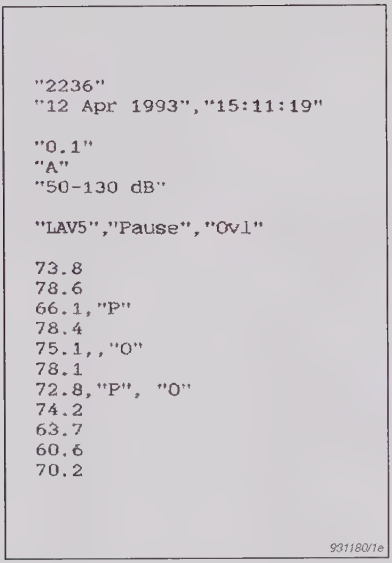
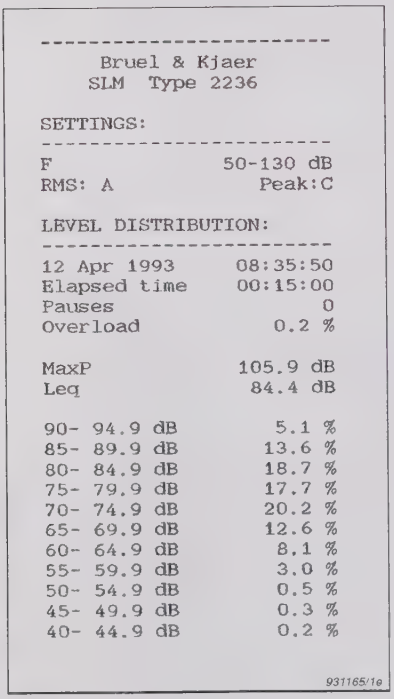


Fig.5.6 Spreadsheet output format with short heading (results logged every 0.1s)

5.5.3 Level Distribution



```
------------------------
     Bruel & Kjaer
    SLM  Type 2236

SETTINGS:
------------------------
F                 50-130 dB
RMS: A              Peak:C

LEVEL DISTRIBUTION:
------------------------
12 Apr 1993       08:35:50
Elapsed time      00:15:00
Pauses                   0
Overload               0.2 %

MaxP                105.9 dB
Leq                  84.4 dB

90- 94.9 dB            5.1 %
85- 89.9 dB           13.6 %
80- 84.9 dB           18.7 %
75- 79.9 dB           17.7 %
70- 74.9 dB           20.2 %
65- 69.9 dB           12.6 %
60- 64.9 dB            8.1 %
55- 59.9 dB            3.0 %
50- 54.9 dB            0.5 %
45- 49.9 dB            0.3 %
40- 44.9 dB            0.2 %
```

931165/1e

Fig. 5.7 Level Distribution output format with a short heading

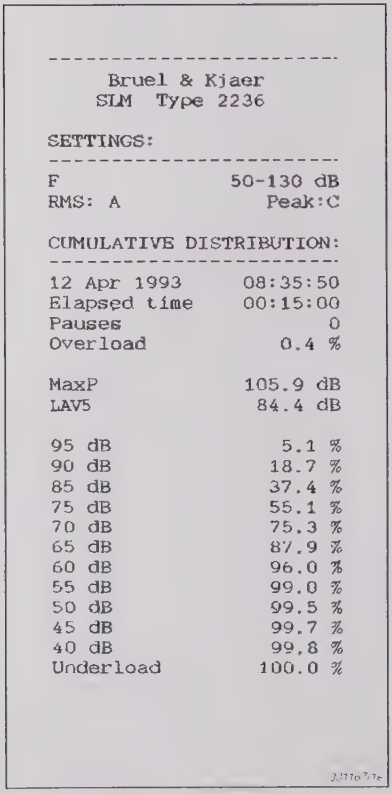
Contains the following information:

- The number of pauses
- The percentage of the measurement time during which the sound level meter was overloaded (OVL)
- MaxP
- The level distribution (i.e. the percentage of the measurement time during which the SPL was within a certain dB range)
- If there has been an underload, the percentage of the measurement time during which the sound level meter was underloaded

All values are to one decimal place.

Level distribution is available with 1 or 5 dB resolution.

5.5.4 Cumulative Distribution



```
------------------------
     Bruel & Kjaer
   SLM  Type 2236

SETTINGS:
------------------------
F                50-130 dB
RMS: A             Peak:C

CUMULATIVE DISTRIBUTION:
------------------------
12 Apr 1993      08:35:50
Elapsed time     00:15:00
Pauses                0
Overload            0.4 %

MaxP              105.9 dB
LAV5               84.4 dB

95 dB               5.1 %
90 dB              18.7 %
85 dB              37.4 %
75 dB              55.1 %
70 dB              75.3 %
65 dB              87.9 %
60 dB              96.0 %
55 dB              99.0 %
50 dB              99.5 %
45 dB              99.7 %
40 dB              99.8 %
Underload         100.0 %
```

Fig.5.8 Cumulative Distribution output format with a short heading

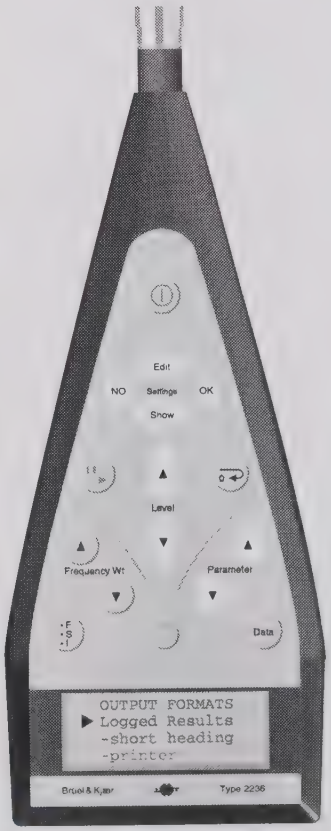
Contains the following information:

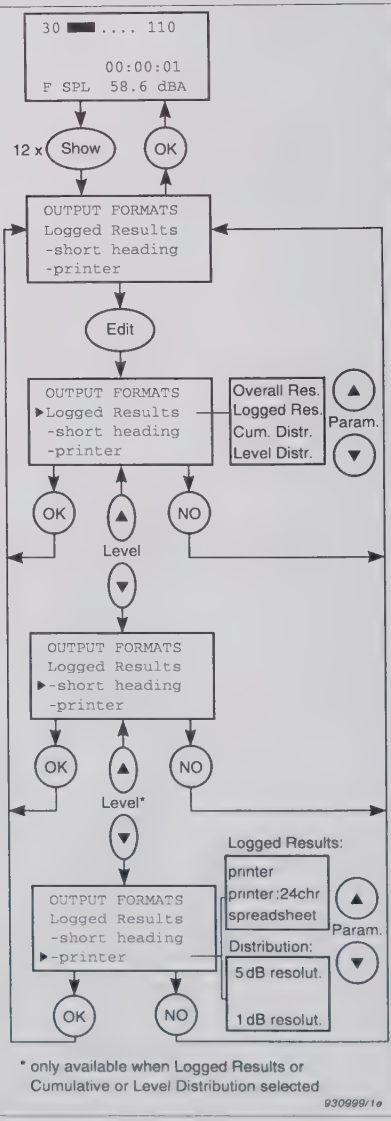
- The number of pauses
- The percentage of the measurement time during which the sound level meter was overloaded (OVL)
- MaxP
- The cumulative distribution (i.e. the percentage of the measurement time during which the SPL was over a certain dB level)
- If there has been an underload, the percentage of the measurement time during which the sound level meter was underloaded

All values are to one decimal place.

Cumulative distribution is available with 1 or 5dB resolution.

5.5.5 Checking and Changing the Output Formats





5.6 Printing

Results can be printed out on Graphics Printer Type 2318 fitted with Serial Interface Module ZI0054 (see Fig. 5.9) or with an IBM® Proprinter compatible serial printer (e.g. Serial Printer WQ1138).

Fig. 5.9 Graphics Printer Type 2318 with Serial Interface Module ZI0054

The baud rates (see section 5.4) of the sound level meter and the printer must be the same to enable them to communicate without losing or corrupting data.

Warning! When connecting the sound level meter to a printer, ensure that both the printer and the sound level meter are switched off. Otherwise the instruments could be damaged.

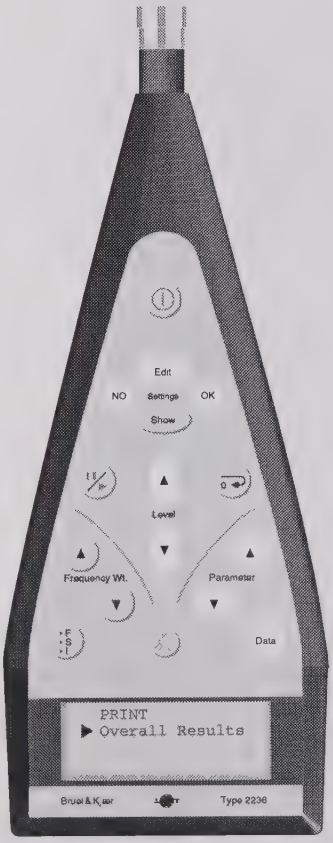
To print:

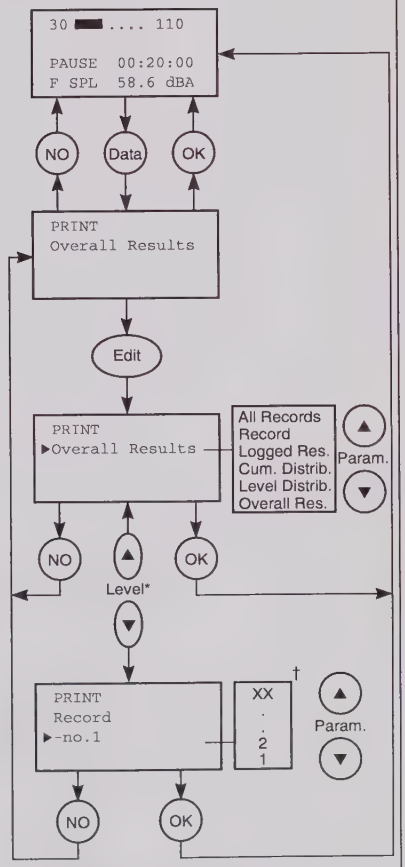
1. Connect the printer to the sound level meter via the **Serial Interface** socket on the base of the sound level meter.

   Use Interface Cable AO0404 with Graphics Printer Type 2318. Use 9-pole Cable with 25-pole Adaptor AO1386 to connect a serial printer with a 25-pole interface socket. If it has a 9-pole interface socket, remove the adaptor.

2. Set up the Output Format of the results you want to print (see section 5.5). For printing Logged Results on a 2318, select Printer (24 char./line). For an IBM® Proprinter or compatible (e.g. Serial Printer WQ1138), select Printer.

3. Set the sound level meter in Pause mode and follow the instructions given in the figure below.





931043/1e

930516/1e

The printer prints the selected results in the selected output format (see section 5.5).

Errors

If the printer does not print out, check:

- The baud rates of the sound level meter and printer. If they are not the same, switch the printer off, correct the sound level meter's baud rate (see section 5.4) so that it is the same as the printer's and switch the printer on again (some printers only check the baud rate while switching on)
- The interface cable between the sound level meter and the printer

If neither of these steps work, consult your local Brüel&Kjær service representative.

5.7 Transferring Results to a Computer

You can also control the sound level meter from a computer (see section 8.4).

Warning! When connecting the sound level meter to the computer, ensure that both the computer and the sound level meter are switched off. Otherwise the instruments could be damaged.

To transfer:

1. Connect the PC to the sound level meter via the **Serial Interface** socket on the base of the sound level meter using 9-pole Cable with 25-pole Adaptor AO1386. If the computer has a 9-pole interface socket, remove the adaptor.

2. Start a communications program (e.g. BK–Link or Pro-Comm) on the computer.

3. Configure the computer as follows:

   9600 Baud
   8 data bits
   1 stop bit
   Parity: none
   Handshake: hardwire or XON/XOFF

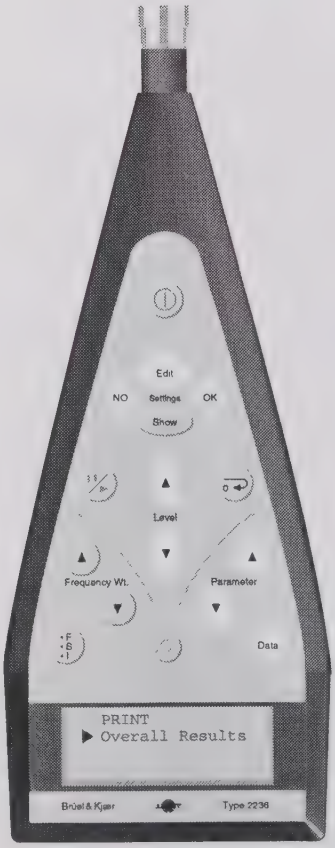
4. On the computer, enter the name of the file to which you want the results to be transferred (see the instruction manual for the communications program).

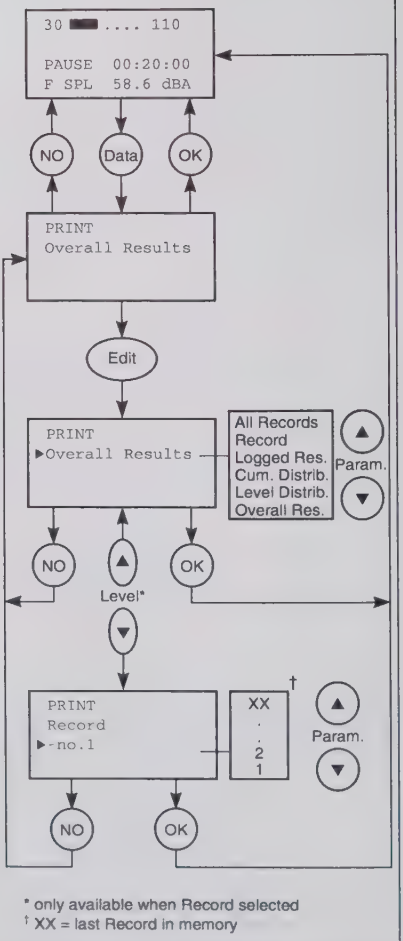
5. Set the sound level meter's baud rate to 9600 (see section 5.4).

   The baud rates of the sound level meter and the computer must be the same to enable them to communicate without losing or corrupting data.

6. Set up the Output Format of the results you want to transfer (see section 5.5). For later use of Logged Results in a spreadsheet program, select the Spreadsheet format.

7. Set the sound level meter in Pause mode and follow the instructions given in the figure below.





931043/1e

930516/1e

The results are transferred to the computer under the name you have chosen from the computer program. You can then import the results into a spreadsheet program (e.g. Excel).

Errors

If the results are not transferred, check:

- The baud rates of the sound level meter and computer. If they are not the same, correct the sound level meter's baud rate (see section 5.4) so that it is the same as the computer's and switch the computer on again
- Which port is used on the computer
- The interface cable between the sound level meter and the computer

If none of these steps work, consult your local Brüel&Kjær service representative.

5.8 Recording on a DAT-recorder

Recording signals on a DAT-recorder via the sound level meter is useful for getting a calibrated recording for full analysis of impulsive noise or for examining the noise for pure tones. Also, later on, you can listen to the signal in order to be able to identify certain events such as a barking dog or slamming door.

To record:

1. Connect the DAT recorder to the sound level meter via the **AC Out** socket on the base of the sound level meter using LEMO to BNC Cable AO0403.

   An adaptor may be required for the input sockets of certain DAT-recorders.

2. Set the maximum input of the DAT-recorder to at least $500\,mV_{rms}$.

3. Set the sound level meter to a suitable range.

It is important to do this to ensure that you know what range the recorded signal represents.

4. Start recording.

5. Record the calibration signal from the calibrator.

   This will allow you to accurately adjust the sensitivity of the analysis equipment on playback.

6. Measure.

7. After measuring, record the calibration signal again.

8. Stop recording and switch the sound level meter off.

For more information on recording using a DAT-recorder, see the recorder's manual.

Errors

If the DAT-recorder does not record, check:

- The cable between the sound level meter and the DAT-recorder
- The DAT-recorder

If neither of these steps works, consult your local Brüel & Kjær service representative.

Chapter 6

Specifications

6.1 Specifications ..... 6 – 2

6.2 Ordering Information ..... 6 – 9

6.1 Specifications

Standards:

Conforms with ANSI S1.4 – 1983 and Draft S1.43, 6th September, 1992 Type 1, and IEC 651 (1979) and 804 (1985) Type 1 l

1/1-octave filter set conforms with ANSI S1.11-86, order 3, Type 1-D and IEC225 – 1966 (Types 2236 C–007 and 2236 D–007 only)

Measuring Ranges:

Range (dB)	Max. Peak level	Upper limit (RMS) for signals with crest factor = 10 (20dB)
10* – 90	93	73
20† – 100	103	83
30 – 110	113	93
40 – 120	123	103
50 – 130	133	113
60 – 140	143	123

* Only available with Types 2236 C–007 and 2236 D–007 when filter selected.
Measurements near this limit are affected by the sound level meter's noise floor and are, therefore, less accurate
† Measurements near this limit are affected by the sound level meter's noise floor and are, therefore, less accurate

Noise Floor:

Typically 18dB(A) RMS
Includes preamplifier's electrical noise and microphone's thermal noise

Frequency Weighting:

Selected independently for RMS and Peak
RMS:
A, C according to IEC651 Type 1
L: As shown in Fig.6.1 with Type 1 tolerances
Filter*:
Band-pass Filters: Eight 1/1-octave filters at 1/1-octave intervals (base 10)
Centre Frequencies: 31.5, 63, 125, 250, 500Hz, 1, 2, 4, 8kHz
Characteristics: As shown in Figs. 6.2 and 6.3
Peak:
C according to IEC651 Type 1
L: As shown in Fig.6.1 with Type 1 tolerances

Detectors:

Simultaneous RMS and Peak with independent frequency weightings
Linearity Range: 80dB
Pulse Range: 83dB
Non-linear Distortion: Too small to affect accuracy
Peak Detector Rise Time: <50µs

* Only available with Types 2236 C–007 and 2236 D–007 when filter selected.

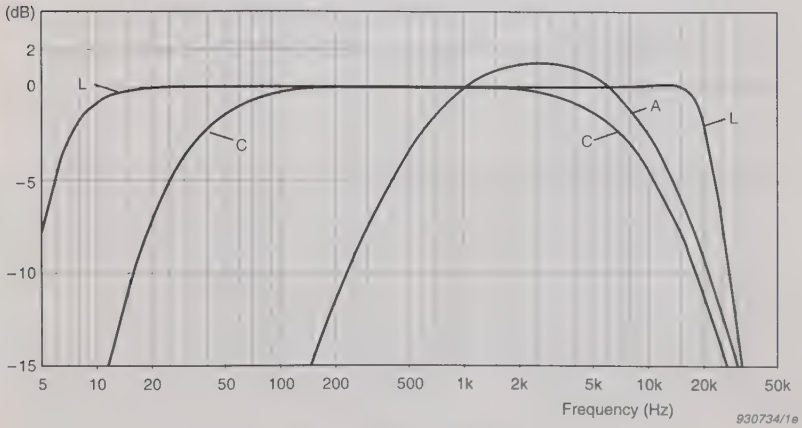


Fig.6.1 Nominal frequency weighting characteristics

Time Weighting:

S, F, I according to IEC651 Type 1 (typically better than Type 0). See Fig.6.4
When Logging Every 0.1 s: 5 ms (indicated on the display by Q)

Display:

4 line LCD showing:

- Measuring range and quasi-analogue bar showing input signal

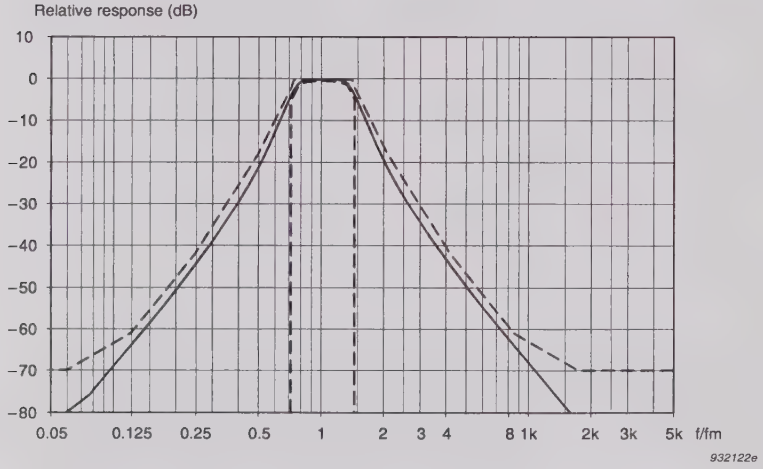


Fig.6.2 $^1/_1$-octave filter characteristics as a function of frequency, f, against centre frequency, f_m

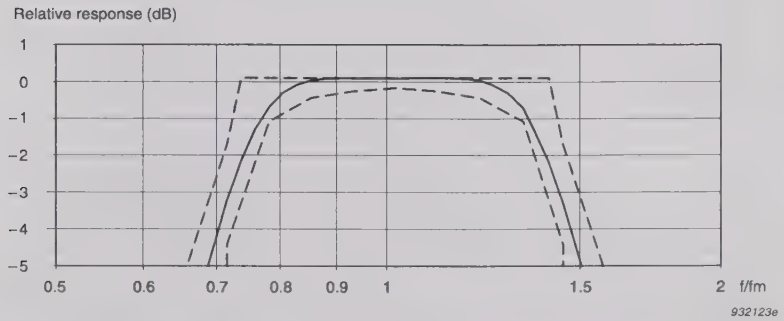


Fig.6.3 $^1/_1$-octave filter characteristics as a function of frequency, f, against centre frequency, f_m (detail of Fig.6.2)

- Battery low, pause and overload with hold indicators
- Time weighting and elapsed measurement time
- Frequency weighting (Peak or RMS) or filter centre frequency*, selected parameter with level

Optional back-light
The quasi-analogue bar is updated 15 times per second
Displayed parameter level updated once per second

Parameters:

MaxL, MinL, MaxP, Peak, SPL, L_{eq}, $L_{AV,4}$, $L_{AV,5}$, L_{Im}, SEL, IEL, $L_{EP,d}$, L_N (3 values with L_{90}, L_{50} and, L_{10} as default) and Overload in % of measurement time
Resolution:
L_N Values: 0.5dB
Other Parameters: 0.1dB

Exchange Rate:

3, 4 or 5dB

Reset:

Resets Buffer (including elapsed time) to zero
Warning prior to reset if elapsed time > 1min.
Reset when changing Exchange Rate, frequency or time weighting
Resets all results in Log, Memory and Buffer if held down together with ⟨**Data**⟩
Optional reset when changing level of measurement range (L_Ns and distributions not available if range change is without reset)

* Only available with Types 2236 C–007 and 2236 D–007 when filter selected.

Memory:

40 Records of Overall Results

Result Logging:

L_{eq}†, L_{10} and L_{90}
Logged Every: 0.1‡, 1, 10s, 1, 10, 30min. and 1hour
Logged To: log or interface
Memory Capacity: 128KBytes (Types 2236 A–007 and 2236 C–007). Equivalent to 21600 sets of results (for example, 6hrs of 1s logging). 512KBytes (Types 2236 B–007 and 2236 D–007). Equivalent to 86400 sets of results (for example, 24hrs of 1s logging)

Microphone:

Type 4188 prepolarized free-field 1/2″ condenser microphone
Sensitivity: –30dB re 1V/Pa ±2dB
Frequency Range: 8Hz to 12.5kHz ±2dB
Capacitance: 12pF

Serial Interface:

Compatible with EIA–574
Compatible with EIA–232–E with 25-pole adaptor
Baud Rate: 1200 – 19200
Data Bits: 8
Stop Bit: 1
Parity: None
Handshake: Hardwire or XON/XOFF
Result Output Formats:
Overall and Logged Results, Level and Cumulative Distribution
Heading: Short

† L_{eq}, $L_{AV,4}$ or $L_{AV,5}$, dependent on Exchange Rate
‡ Only L_{eq}, $L_{AV,4}$ or $L_{AV,5}$ logged

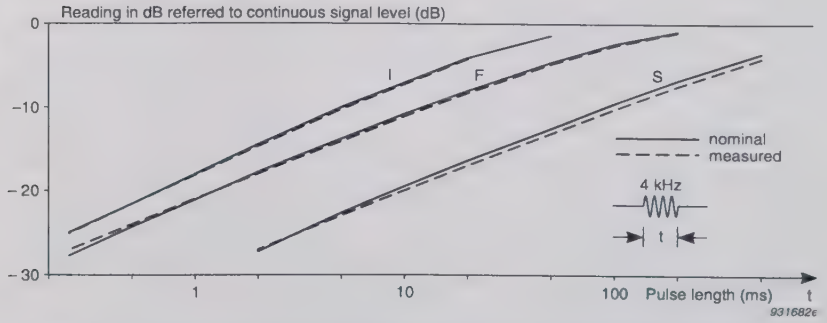


Fig.6.4 Response of the sound level meter to tone bursts of varying characteristics

Logged Results Formats: Printer, Printer (24 char./line) or Spreadsheet
Distribution Resolution: 1 or 5dB

DC Output:

Short-circuit protected 1-pin LEMO socket (00 size)
Output: 50mV/dB equivalent to 0 – 4.15V
Output Resistance: 100Ω
Output Parameter: SPL

AC Output:

Short-circuit protected 1-pin LEMO socket (00 size)
Max. Output: 0.5V RMS corresponding to the top of the selected measurement range ±2dB depending on the microphone's sensitivity
Output Resistance: 100Ω
Output: Output signal from preamplifier (L frequency weighting)

Clock:

Adjustable real-time (calendar) and measurement duration
Factory set to **CET (GMT+1)**

Warm-up Time:

<5s

Settling Time:

At Range Change without Reset: <4ms

Calibration Conditions:

Reference Frequency: 1000Hz
Reference SPL: 94dB (pressure field)
Reference Range: 50–130dB (set automatically during calibration sequence)
Reference Direction of Incidence: Frontal
Calibration Correction with Extension Cable: 0dB

Environmental Effects:

Storage Temperature: –25 **to +70°C** (–13 **to** +158°F)
Operating Temperature: –10 to +50°C (14 **to 122°F)**
Effect of Temperature: <0.5dB (–10 to +50°C)
Effect of Humidity: <0.5dB for 30%<RH<90% (at 40°C, 1kHz)

Vibration Sensitivity

<80dB with L-weighting at 1m/s^{-2}

Effect of Magnetic Field

80A/m (1Ørsted) at 50Hz gives <34dB

Electromagnetic Compatibility:

Designed to Fulfil:
Emission:
EN50081–1: residential, commercial and light industry (including EN55022 class B)
EN50081–2: industrial environment
FCC class B part 15J
CISPR22 class B
Immunity:
EN50082–1: residential, commercial and light industry
prEN50082–2: industrial environment

Batteries:

Four 1.5V LR6/AA size alkaline cells
Lifetime (at room temperature): Typically >12hrs for Types 2236A–007 and 2236B–007. Typically >10hrs for Types 2236C–007 and 2236D–007
Internal back-up battery:
Charging time: ~10hours (1st time)
Keeps clock and memories operating for at least 6months (typically) if fully charged

External Power Supply:

Must fulfil the following specifications
Voltage: regulated or smoothed 7–15V DC
Voltage Ripple: <100mV peak to peak
Maximum Current: 400mA
Average Current: ~100mA
Socket:
Pin: Positive
Casing: Signal Ground
Pin Diameter: 2.0mm
External Diameter: 5.5mm

Physical Characteristics:

Size: 257×97×41mm
Weight: 460g (incl. batteries)

Frequency Response

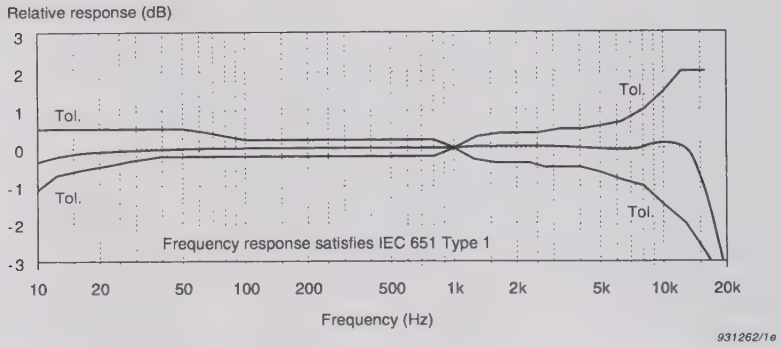


Fig. 6.5 Typical free-field response of Microphone Type 4188 for 0° incidence without random incidence corrector

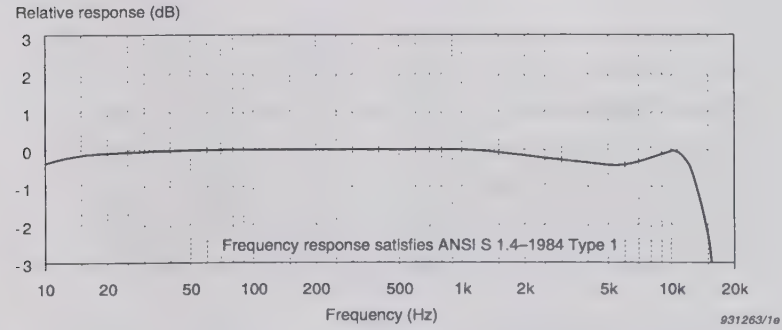


Fig. 6.6 Typical diffuse-field response of Microphone Type 4188 with random incidence corrector

Directional Characteristics:

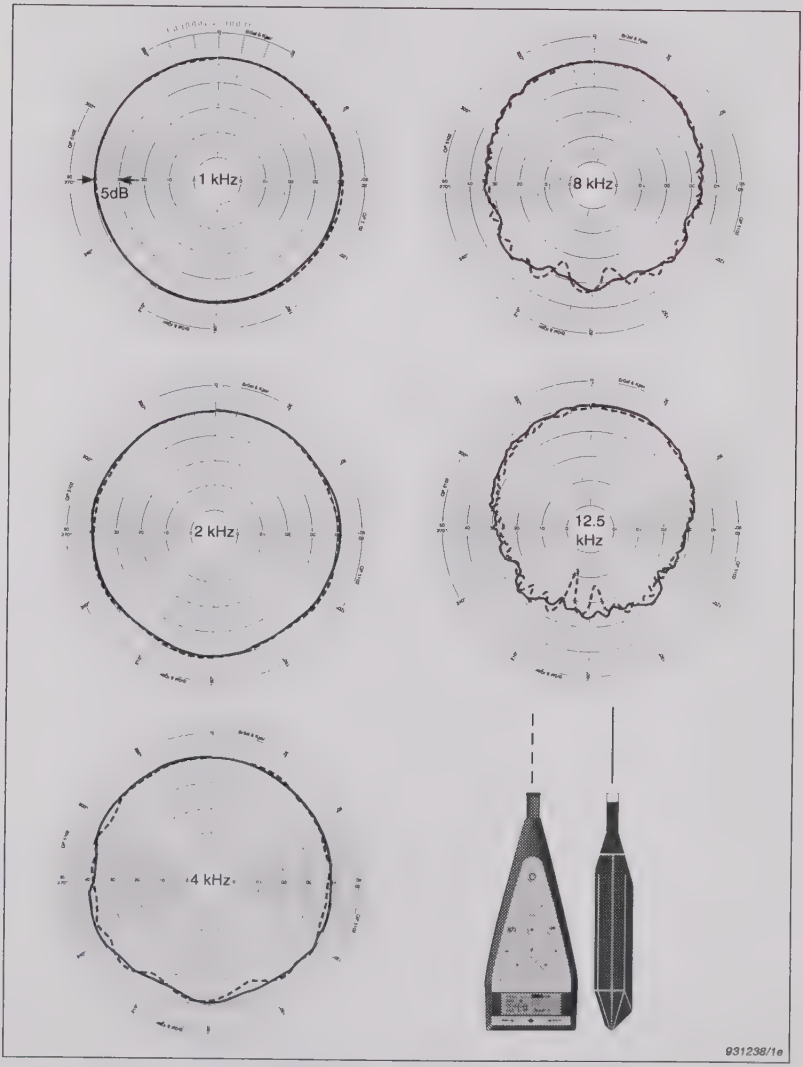


Fig. 6.7 Directional characteristics of the complete instrument at 1, 2, 4, 8, 12.5kHz

Effect of Accessories

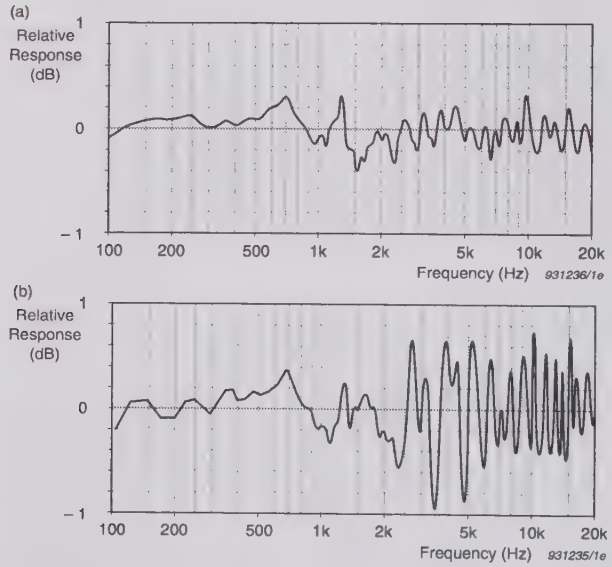


Fig. 6.8 (a) Effect of the sound level meter's casing on its frequency response (for reference) compared to (b) the effect of Tripod UA0801 on the sound level meter's frequency response

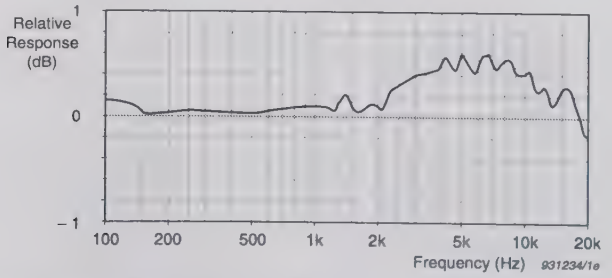


Fig. 6.9 Effect of Protective Cover UA1236 on the sound level meter's frequency response

6.2 Ordering Information

Type 2236 A	Precision Integrating Sound Level Meter
Type 2236 B	Precision Integrating Sound Level Meter (extended memory)
Type 2236 C	Precision Integrating Sound Level Meter with 1/1-octave filter set
Type 2236 D	Precision Integrating Sound Level Meter with 1/1-octave filter set (extended memory)

include the following accessories:

4×QB0013:	Four 1.5V LR6/AA size alkaline cells
Type 4188:	Prepolarized Condenser Microphone Cartridge
KE0323:	Shoulder Bag
UA1236:	Protective Cover

Optional Accessories:

For measuring:

Type 4231:	Sound Level Calibrator
Type 4226:	Multifunction Acoustic Calibrator
UA1251:	Tripod
UA0801:	Tripod
UA1246:	Tripod Arm
UA1254:	Microphone Holder (for tripod)
UA0237:	Windscreen
UA0459:	Windscreen
AO0408:	Microphone Extension Cable (3m)
AO0409:	Microphone Extension Cable (10m)

For transferring results to a Personal Computer:

AO1386:	9-pole Cable with 25-pole Adaptor

For recording on a DAT recorder, transferring signals to an analyzer or using with headphones:

AO0403:	LEMO to BNC Cable

For printing:

Type 2318:	Graphics Printer
WQ1138:	Serial Printer
AO0404:	9-pole to LEMO Cable (for 2318)
AO1386:	9-pole Cable with 25-pole Adaptor (for serial printer)

Upgrades:

ZT0326:	Octave Filter Set

Carrying Cases:

KE0325:	Carrying Case with insert for sound level meter, Sound Level Calibrator Type 4231, Serial Printer WQ1138 and Tripod UA1251

Brüel&Kjær reserves the right to change specifications and accessories without notice.

Chapter 7

Service and Repair

Precision Integrating Sound Level Meter Type 2236 is designed and constructed to provide many years of reliable operation. However, if a fault occurs which impairs the sound level meter's correct function, then remove its main batteries and disconnect any external power supply to prevent risk of further damage.

For repair, contact your local Brüel & Kjær service representative.

Chapter 8

Appendices

8.1 Exchange Rate ..... 8 – 2

8.2 SEL ..... 8 – 4

8.3 $L_{EP,d}$ ..... 8 – 5

8.4 Controlling the Sound Level Meter from a Computer ..... 8 – 6

Introduction ..... 8 – 6
Commands ..... 8 – 8

8.1 Exchange Rate

When measuring noise for the evaluation of hearing risk, the time factor has an important influence.

It is generally assumed that doubling the noise energy also doubles the hearing risk. This means that if the noise energy is doubled (i.e. it increases by 3 dB) the allowed exposure time should be halved.

Thus, as the equal energy concept requires a halving of the exposure time for a 3 dB increase in level (L_{eq}), it is said to have an Exchange Rate of 3 dB. This is standardized by ISO.

However, in the USA, the OSHA regulation allows a 5 dB increase in level for each halving of the exposure time (i.e. the Exchange Rate is 5 dB). It therefore uses an L_{AV} with this Exchange Rate. This $L_{AV,5}$ (or L_{OSHA}) has a different relationship between level and time than the equal energy concept standardized by ISO.

This is shown in Fig. 8.1. Going from an exposure time of 8 hours to 4 hours allows an increase of 3 dB in the L_{eq} in accordance with ISO but an increase of 5 dB in the $L_{AV,5}$ inaccordance with OSHA.

An Exhange Rate of 4 dB also exists ($L_{AV,4}$ or L_{DOD}).

The Exchange Rate determines which L_{eq} parameter the sound level meter measures (see Table 8.1) and whether the sound level meter can measure $L_{EP,d}$.

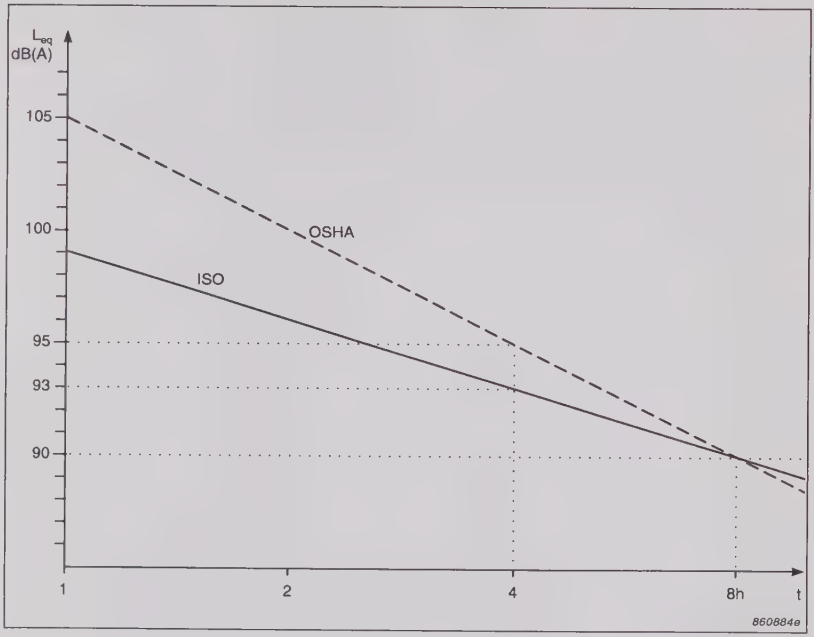


Fig. 8.1 The effect of an Exchange Rate of 3 or 5 dB

Exchange Rate (dB)	L_{AV} Parameter
3	L_{eq} (accesses $L_{EP,d}$)
4	$L_{AV,4}$ (L_{DOD})
5	$L_{AV,5}$ (L_{OSHA})

Table 8.1 The L_{AV} parameter measured by the sound level meter is dependent on the Exchange Rate

8.2 SEL

SEL (the Sound Exposure Level) is the constant sound level in dB which, if maintained over 1s, would have the same energy as the measured L_{eq} over the measurement time, T (see Fig. 8.2).

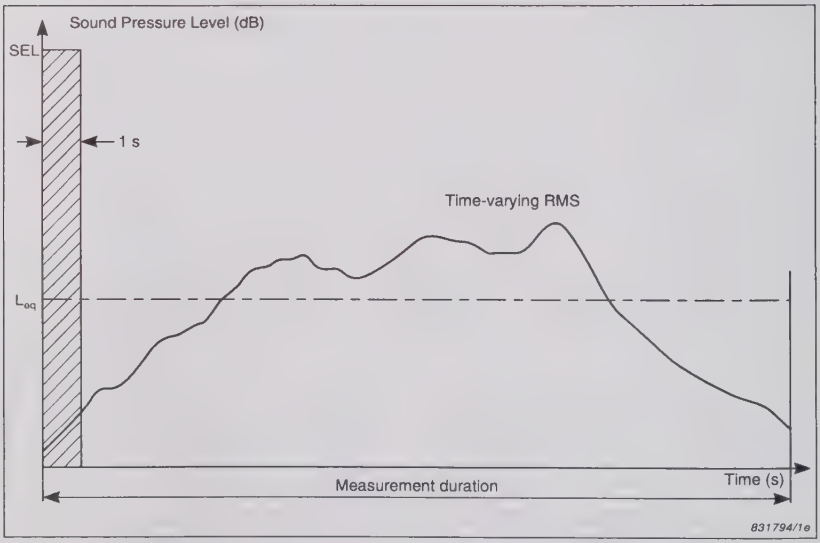


Fig. 8.2 SEL compared to time-varying RMS signal and L_{eq}

If the time weighting is I, SEL becomes IEL.

8.3 $L_{EP,d}$

$L_{EP,d}$ (the Daily Personal Noise Exposure Level) is the constant sound level which, if maintained over 8hours, would have the same energy as the measured A-weighted L_{eq} extended over the Exposure Time, T_e (see Fig. 8.3).

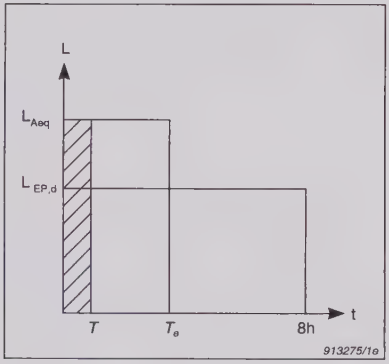


Fig. 8.3 $L_{EP,d}$ compared to L_{Aeq}

In Fig. 8.3:

L_{Aeq} = the average level during the Exposure Time

T = the actual measurement time

T_e = The Exposure Time

The Exposure Time can be set using the sound level meter's Settings (see section 3.9). Therefore, you can investigate the effect of different Exposure Times on the $L_{EP,d}$.

Note: $L_{EP,d}$ is only available if the Exchange Rate is 3dB.

8.4 Controlling the Sound Level Meter from a Computer

8.4.1 Introduction

Messages from the Sound Level Meter

This section describes the operation of the sound level meter via its serial interface. It assumes that you are familiar with manual operation of the sound level meter and have some experience of interface programming.

Command Syntax

All commands can be truncated to a mnemonic indicated by capitals in the section title:

e.g. AUTOLog can be written as AUTOL

If a command is unknown, the sound level meter sends the following message:

UNKNOWN COMMAND

If a parameter following a command is unknown, the sound level meter normally treats the command message as a query message. In some cases, the sound level meter sends an explanatory message instead.

All messages sent to the sound level meter must end with ⟨**CR**⟩.

All messages from the sound level meter end with ⟨**CR**⟩.

Note: In the syntax diagrams in section 8.4.2, SP represents ⟨**Space bar**⟩ and CR represents ⟨**CR**⟩.

Setting up the Computer

Warning! When connecting the sound level meter to the computer, ensure that both the computer and the sound level meter are switched off. Otherwise the instruments could be damaged.

1. Connect the computer to the sound level meter via the **Serial Interface** socket on the base of the sound level meter using 9-pole Cable with 25-pole Adaptor AO1386. If the computer has a 9-pole interface socket, remove the adaptor.

2. Start a communications program (e.g. BK–Link or Pro-Comm) on the computer.

3. Configure the computer as follows:

   9600 Baud
   8 data bits
   1 stop bit
   Parity: none
   Handshake: hardwire or XON/XOFF (see section 5.4).

4. Turn on the sound level meter.

5. Set the sound level meter's handshake to hardwire or XON/XOFF and its baud rate to 9600 (see section 5.4).

6. Press ⟨**Enter**⟩ on the computer.

   Communication is established and the prompt (>) is shown on the PC screen. The sound level meter can now be controlled from the PC.

Note: The baud rates of the sound level meter and the computer must be the same to enable them to communicate without losing or corrupting data.

8.4.2 Commands

Message	Command	Query	Message	Command	Query
AUTOLog	•	•	FW	•	•
AUTOStart	•	•	HAndshake	•	•
BATt		•	OFf	•	
BAUd	•	•	PAuse	•	
CLock	•	•	PErcentile	•	•
CONtinue	•		PRint	•	
DEFault	•		PW	•	•
DISp	•	•	RANge	•	•
ELapsed		•	RESet	•	
EXChange	•	•	SETup		•
EXPosure	•	•	TW	•	•
FOrmat	•	•	VErsion		•
FREE		•			

Table 8.2 Command and query message overview

The command and query messages available are listed in Table 8.2.

AUTOLog

The **AUTOL**og command message sets the destination of the data and rate of logging. The query message shows the current status. When logging data over the interface, the sound level meter cannot be controlled from the PC except to change the status of the auto logging. Changing the rate of logging data resets the sound level meter. The data fields and their settings are listed in Table 8.2.

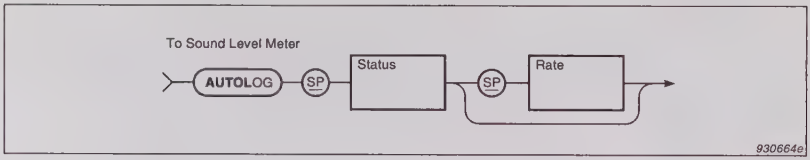


Fig. 8.4 Syntax for the AUTOLog command

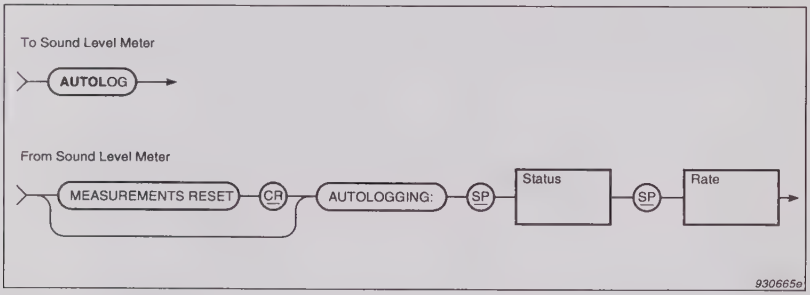


Fig. 8.5 Syntax for the AUTOLog query message and sound level meter response

Field Name	Field Setting	Comments
Status (command)	I L O	To interface To internal log Off
Rate	0.1 1s 10s 1m 10m 30m 1h	0.1 s, L_{eq} only* 1minute 1hour
Status (response)	INTERFACE LOG OFF	

* Causes TW Status to be set to Q. TW Status cannot be changed while AUTOLog Rate is 0.1 and Status is not Off

Table 8.3 AUTOLog data fields and codes

AUTOStart

The **AUTOS**tart command message sets the auto start time, day of the month and status. The query message shows the current auto start status. The data fields and their settings are listed in Table 8.4.

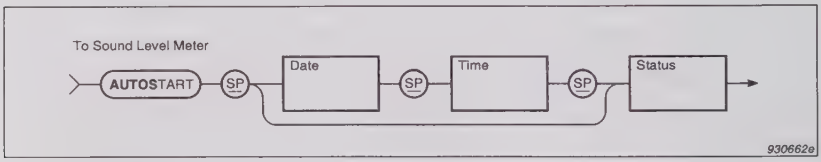


Fig. 8.6 Syntax for the AUTOStart command

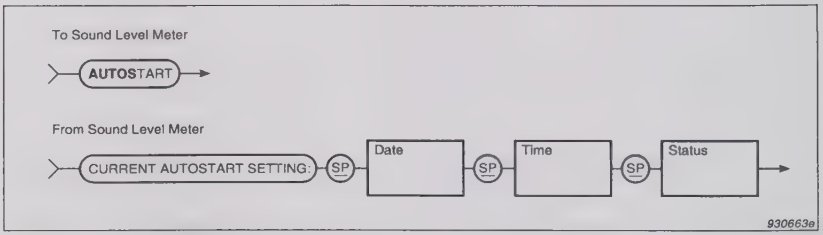


Fig. 8.7 Syntax for the AUTOStart query message and sound level meter response

Field Name	Field Setting	Comments
Date	DD	Up to 1 month ahead
Time	HH:MM:SS	
Status	ON OFF	

Table 8.4 AUTOStart data fields and codes

BATt

The **BAT**t query message shows the current voltage level and status of the battery. Together with the FREE command, it is equivalent to the Status Fast Edit function available from the front plate of the sound level meter. The data fields and their settings are listed in Table 8.5.

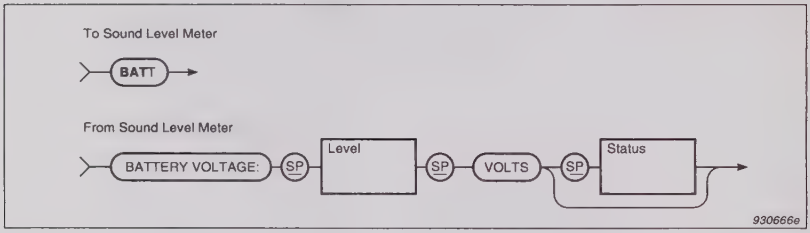


Fig. 8.8 Syntax for the BATt query message and sound level meter response

Field Name	Field Setting	Comments
Level	XX.X	Volts
Status	LOW	Replace batteries

Table 8.5 BATt data fields and codes

BAUd

The **BAU**d command message sets the sound level meter's baud rate. After you have changed the sound level meter's baud rate, you must change the computer's to the same baud rate in order to continue communicating with the sound level meter.

The query message shows the current baud rate. The data fields and their settings are listed in Table 8.6.

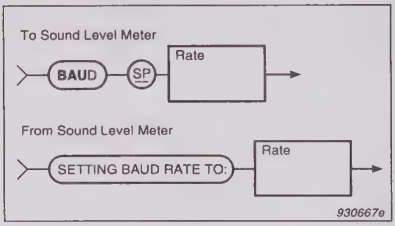


Fig. 8.9 Syntax for the BAUd command

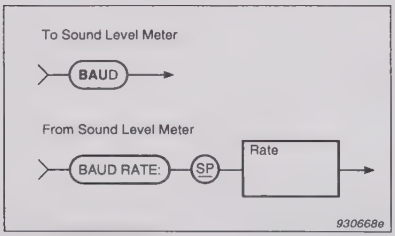


Fig. 8.10 Syntax for the BAUd query message and sound level meter response

Field Name	Field Setting	Comments
Rate (command)	12 24 48 96 192	1200 2400 4800 9600 19200
Rate (response)	1200 2400 4800 9600 19200	

Table 8.6 BAUd data fields and codes

CLock

The **CL**ock command message sets the date and time on the sound level meter's calendar and clock. The query message shows the date and time on the sound level meter's calendar and clock. The data fields and their settings are listed in Table 8.7.

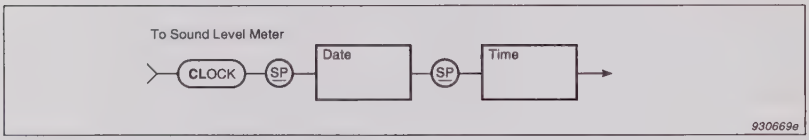


Fig. 8.11 Syntax for the CLock command

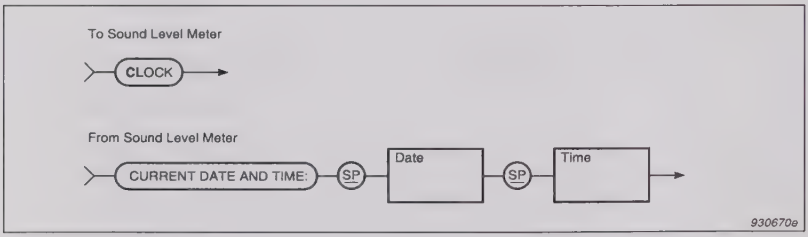


Fig. 8.12 Syntax for the CLock query message and sound level meter response

Field Name	Field Setting
Date	YYYY-MM-DD
Time	HH:MM:SS

Table 8.7 CLock data fields and codes

CONtinue

The **CON**tinue command message starts a measurement without resetting the sound level meter.

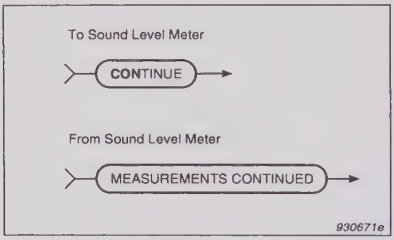


Fig. 8.13 Syntax for the CONtinue command

DEFault

The **DEF**ault command message sets the sound level meter to its default set-up.

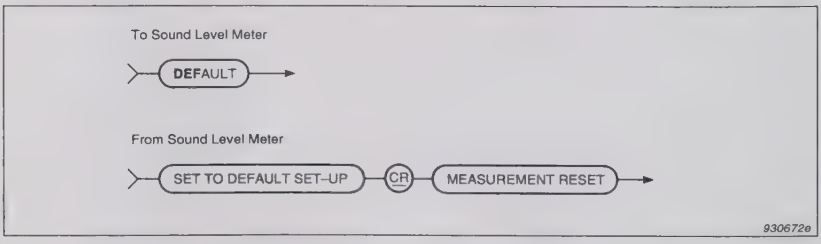


Fig. 8.14 Syntax for the DEFault command

DISp

The **DISp** command message sets the parameter to be shown on the sound level meter's screen. The query message shows the current displayed parameter, its current level and if the sound level meter is or has been overloaded since the last reset. The data fields and their settings are listed in Table 8.8.

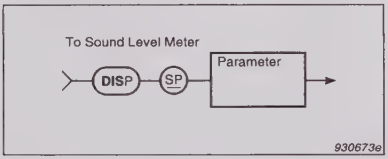


Fig. 8.15 Syntax for the DISp command

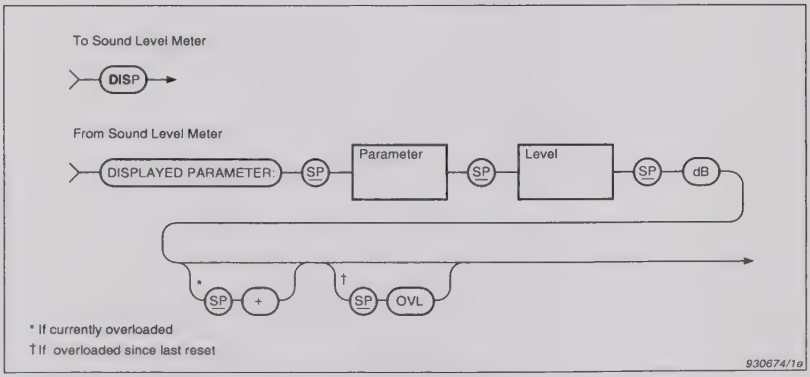


Fig. 8.16 Syntax for the DISp query message and sound level meter response

Field Name	Field Setting	Comments
Parameter (command)	MAXP PEAK SPL MAXL MINL Leq SEL LEPd OVL LN1 LN2 LN3	 Set to L_{eq}, L_{lm}, $L_{AV,4}$ or $L_{AV,5}$ Set to SEL or IEL $L_{EP,d}$ $L_{N(1)}$ $L_{N(2)}$ $L_{N(3)}$
Parameter (query response)	MAXP PEAK SPL MAXL MINL Leq LIm LAV,4 LAV,5 SEL IEL LEPd OVL LN1 LN2 LN3	 L_{eq} L_{lm} $L_{AV,4}$ $L_{AV,5}$ $L_{EP,d}$ $L_{N(1)}$ $L_{N(2)}$ $L_{N(3)}$
Level	XXX.X	dB

Table 8.8 DISp data fields and codes

ELapsed

The **ELa**psed query message shows the current elapsed measurement time. The data fields and their settings are listed in Table 8.9.

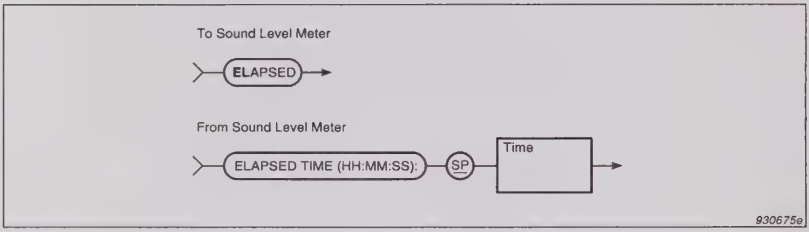


Fig. 8.17 Syntax for the ELapsed query message and sound level meter response

Field Name	Field Setting
Time	HH:MM:SS

Table 8.9 ELapsed data fields and codes

EXChange

The **EXC**hange command message sets the Exchange Rate. The query message shows the current Exchange Rate. The data fields and their settings are listed in Table 8.10.

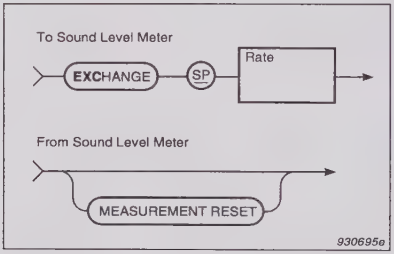


Fig. 8.18 Syntax for the EXChange command

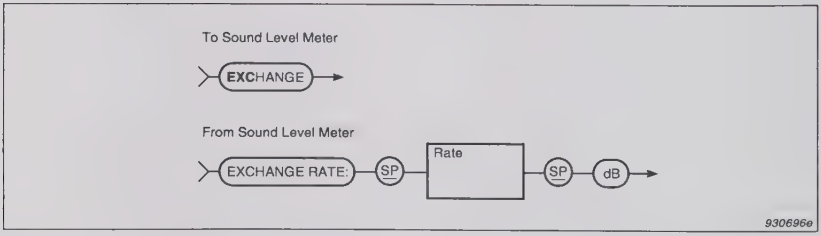


Fig. 8.19 Syntax for the EXChange query message and sound level meter response

Field Name	Field Setting
Rate	3 4 5

Table 8.10 EXchange data fields and codes

EXPosure

The **EXP**osure command message sets the Exposure Time. The query message shows the current Exposure Time. The data fields and their settings are listed in Table 8.11.

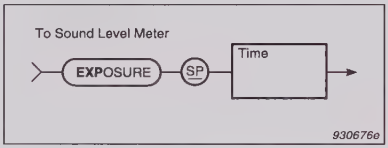


Fig. 8.20 Syntax for the EXPosure command

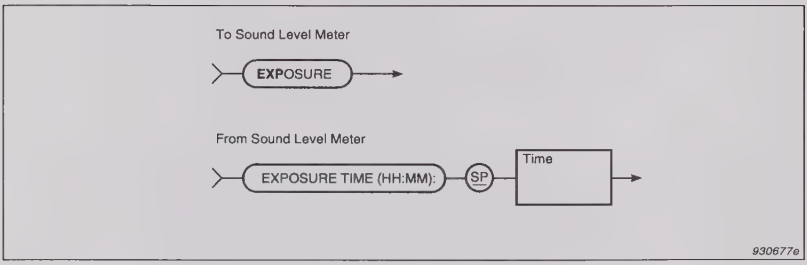


Fig. 8.21 Syntax for the EXPosure query message and sound level meter response

Field Name	Field Setting	Comments
Time	HH:MM	Between 1 min. and 24 hours

Table 8.11 EXposure data fields and codes

FOrmat

The **FO**rmat command message sets the selected Output Format. The query message shows the current Output Format for the selected results. The data fields and their settings are listed in Table 8.12.

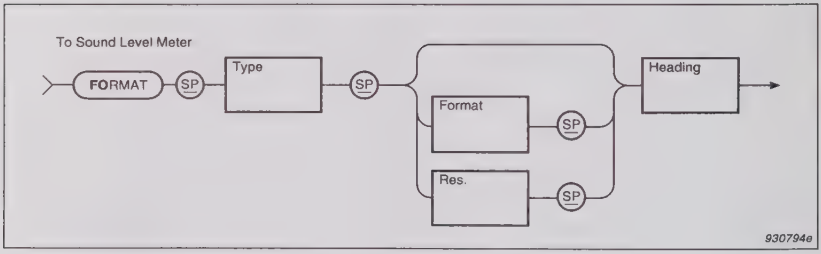


Fig. 8.22 Syntax for the FOrmat command

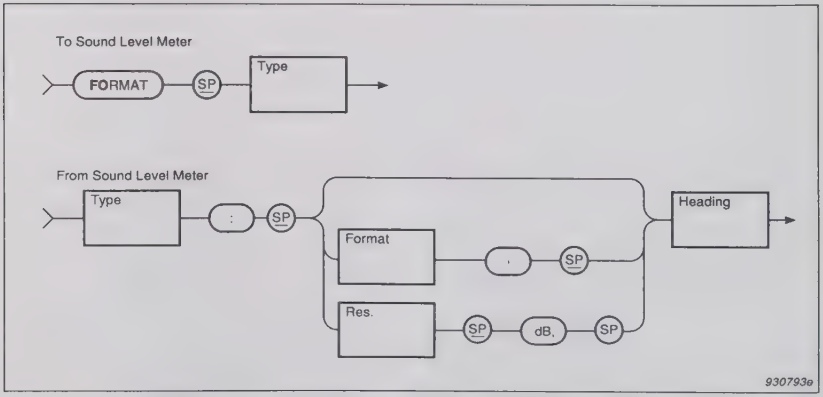


Fig. 8.23 Syntax for the FOrmat query message and sound level meter response

Field Name	Field Setting	Comments
Type (command, query)	O_R L_R L_D C_D	Overall Results Logged Results Level Distribution Cumulative Distribution
Format (command)*	PR24 PR SP	Printer (24 char.) Printer Spreadsheet
Res.†	1 5	dB
Type (query response)	OVERALL RESULTS LOGGED RESULTS LEVEL DISTRIBUTION CUMULATIVE DISTRIBUTION	
Format (query response)	PRINTER 24 CHAR. PRINTER SPREADSHEET	

* Only available if Type is **L**ogged_**R**esults
† Only available if Type is **L**evel_**D**istribution or **C**umulative_**D**istribution

Table 8.12 FOrmat data fields and codes

FREE

The **FREE** query message shows how much time is left in the sound level meter's log at the current logging rate, and how many Records are left in the sound level meter's memory. Together with the BATt command, it is equivalent to the Status Fast Edit function available from the front plate of the sound level meter. The data fields and their settings are listed in Table 8.13.

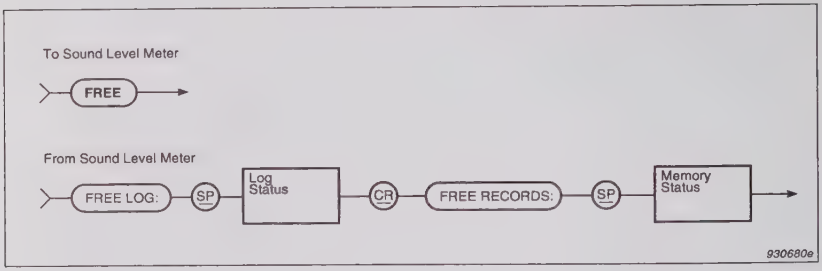


Fig. 8.24 Syntax for the FREE query message and sound level meter response

Field Name	Field Setting	Comments
Log Status	HHH:MM	
Memory Status	XX	Records

Table 8.13 FREE data fields and codes

FW

The **FW** command message sets the frequency weighting of the RMS signal. The query message shows the current frequency weighting of the RMS signal. The data fields and their settings are listed in Table 8.13.

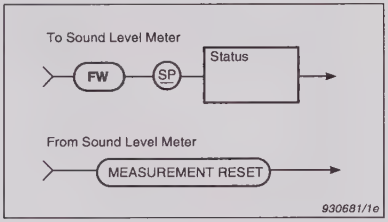


Fig. 8.25 Syntax for the FW command

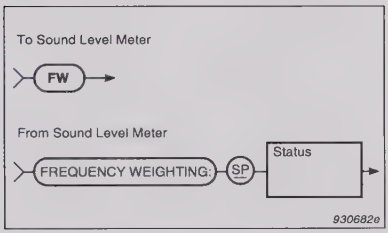


Fig. 8.26 Syntax for the FW query message and sound level meter response

Field Name	Field Setting	Comments
Status (command)	A C L 31* 63* 12* 25* 50* 1K* 2K* 4K* 8K*	 31.5Hz 63Hz 125Hz 250Hz 500Hz 1kHz 2kHz 4kHz 8kHz
Status (response)	A C L 31.5 HZ* 63 HZ* 125 HZ* 250 HZ* 500 HZ* 1 KHZ* 2 KHZ* 4 KHZ* 8 KHZ*	

* Only available with sound level meters with filter sets (Types 2236 C–007 and 2236 D–007)

Table 8.14 FW data fields and codes

HAndshake

The **HA**ndshake command message sets the form of data exchange over the interface. The query message shows the current status. The data fields and their settings are listed in Table 8.15.

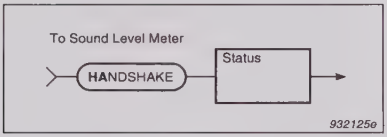


Fig. 8.27 Syntax for the HAndshake command

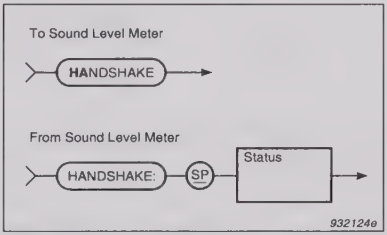


Fig. 8.28 Syntax for the HAndshake query message and sound level meter response

Field Name	Field Setting	Comments
Status (command)	H X N	Hardwire XON/XOFF None
Status (response)	HARDWIRE XON/XOFF NONE	

Table 8.15 HAndshake data fields and codes

OFf

The **OF**f command message switches the sound level meter off. To switch the sound level meter on, send any character to the sound level meter (e.g. ⟨**Break**⟩).

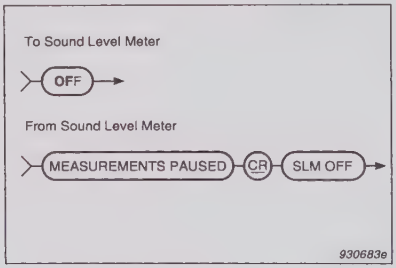


Fig. 8.29 Syntax for the OFf command

PAuse

The **PA**use command message puts the sound level meter in Pause mode.

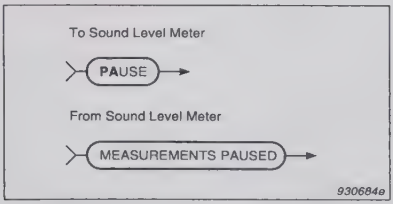


Fig. 8.30 Syntax for the PAuse command

PErcentile

The **PE**rcentile command message sets the selected percentile. The query message shows all the current percentiles. The data fields and their settings are listed in Table 8.16.

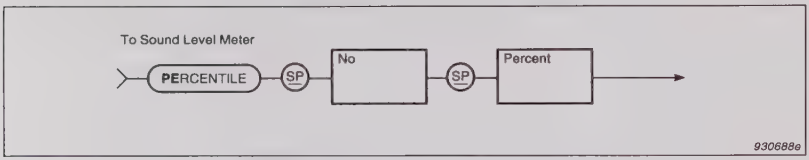


Fig. 8.31 Syntax for the PErcentile command

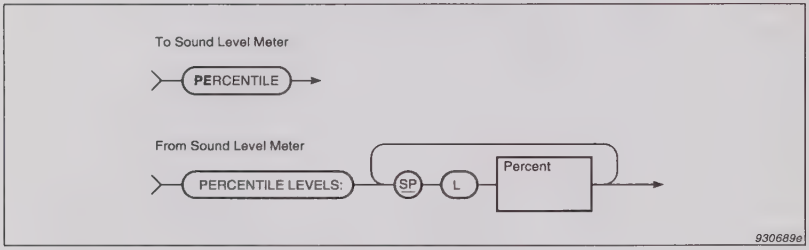


Fig. 8.32 Syntax for the PErcentile query message and sound level meter response

Field Name	Field Setting	Comments
No.	LN1 LN2 LN3	LN1 (default L10) LN2 (default L50) LN3 (default L90)
Percent	X	1 to 99

Table 8.16 PErcentile data fields and codes

PRint

The **PR**int command message prints the selected results in the current output format to a connected printer or PC. If no results are selected, the sound level meter prints the last selected results. The data fields and their settings are listed in Table 8.17.

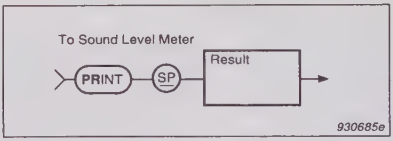


Fig. 8.33 Syntax for the PRint command

Field Name	Field Setting	Comments
Result	O_R	Overall Results
	L_R	Logged Results
	L_D	Level Distribution
	C_D	Cumulative Distribution
	X	Record No. X
	ALL	All Records

Table 8.17 PRint data fields and codes

PW

The **PW** command message sets the frequency weighting of the Peak signal. The query message shows the current frequency weighting of the Peak signal. The data fields and their settings are listed in Table 8.18.

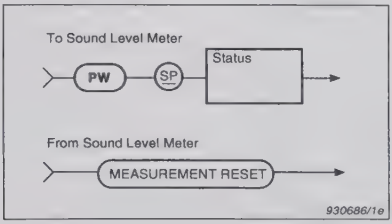


Fig. 8.34 Syntax for the PW command

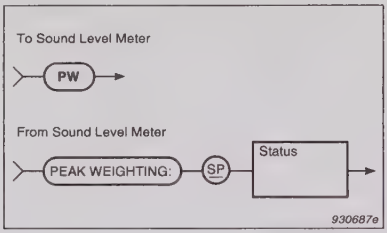


Fig. 8.35 Syntax for the PW query message and sound level meter response

Field Name	Field Setting
Status (command)	C L
Status (query response)	C LIN

Table 8.18 PW data fields and codes

RANge

The **RAN**ge command message sets the measurement range. The query message shows the current measurement range. The data fields and their settings are listed in Table 8.19.

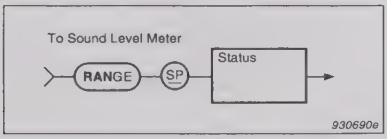


Fig. 8.36 Syntax for the RANge command

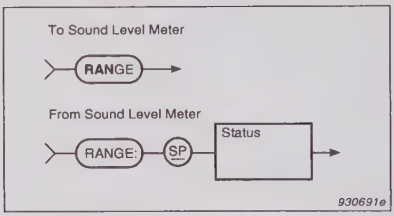


Fig. 8.37 Syntax for the RANge query message and sound level meter response

Field Name	Field Setting	Comments
Status (command)	90* 100 110 120 130 140	10 – 90 20 – 100 30 – 110 40 – 120 50 – 130 60 – 140
Status (query response)	10 – 90* 20 – 100 30 – 110 40 – 120 50 – 130 60 – 140	

* Only available with sound level meters with filter sets (Types 2236 C–007 and 2236 D–007) when RMS Frequency Weighting is 31.5Hz – 8kHz

Table 8.19 RANge data fields and codes

RESet

The **RES**et command message resets the sound level meter.

Note: There is no reset warning.

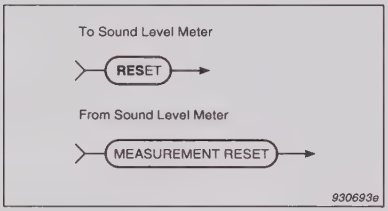


Fig. 8.38 Syntax for the RESet command

SETup

The **SET**up query message shows the sound level meter's current set-up. The data fields and their settings are listed in Table 8.20.

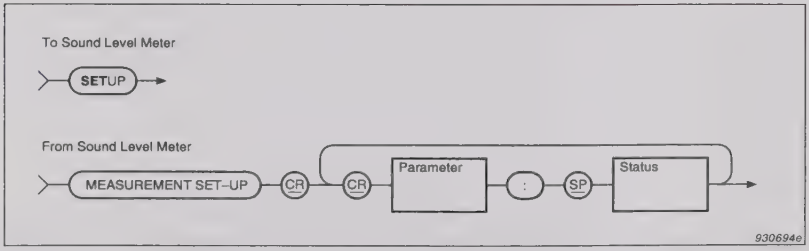


Fig. 8.39 Syntax for the SETup query message and sound level meter response

Field Name	Field Setting	Comments
Parameter	FREQUENCY WEIGHTING PEAK WEIGHTING TIME WEIGHTING DISPLAYED PARAMETER RANGE CHANGE RANGE EXCHANGE RATE PERCENTILE LEVELS AUTO LOGGING AUTO LOGGING RATE EXPOSURE TIME AUTO START	Frequency weighting (RMS) Frequency weighting (Peak)
Status	A/C/L/XXX HZ* C/L FAST/SLOW/IMPULSE XXX XX – XXX dB WITH/WITHOUT RESET X dB LN1 LN2 LN3 INTERFACE/LOG/OFF XX HH:MM ON/OFF	See Table 8.13 Displayed Parameter See Table 8.2

* Only available with sound level meters with filter sets (Types 2236 C–007 and 2236 D–007)

Table 8.20 SETup data fields and codes

TW

The **TW** command message sets the time weighting. The query message shows the current time weighting. The data fields and their settings are listed in Table 8.21.

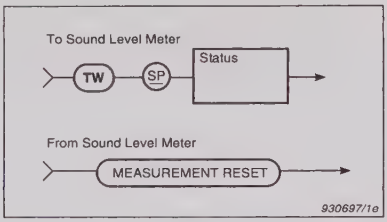


Fig. 8.40 Syntax for the TW command

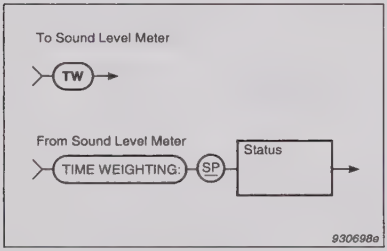


Fig. 8.41 Syntax for the TW query message and sound level meter response

Field Name	Field Setting	Comments
Status (command)	S F I	Slow Fast Impulse
Status (query response)	SLOW FAST IMPULSE Q	 5 ms*

* Appears when AUTOLog Rate is 0.1 and Status is not Off. Cannot be changed while AUTOLog Rate is 0.1 and Status is not Off

Table 8.21 TW data fields and codes

VErsion

The **VE**rsion query message shows the version no. and log capacity, in bytes, of the sound level meter. The data fields and their settings are listed in Table 8.22.

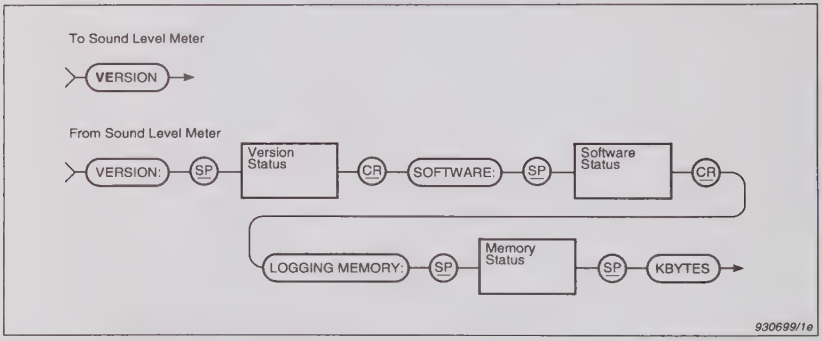


Fig. 8.42 Syntax for the VErsion query message and sound level meter response

Field Name	Field Setting	Comments
Version Status	2236 X–007	X = A, B, C or D
Software Status	1.00 VP 2732	
Memory Status	128* 512†	KBytes

* Available with Precision Integrating Sound Level Meters Types 2236 A–007 and 2236 C–007. Upgrade to 512KBytes available

† Available with Precision Integrating Sound Level Meters Types 2236 B–007 and 2236 D–007

Table 8.22 VErsion data fields and codes

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Controls

1 On/Off
Turns the sound level meter on and off

2 Edit
Edits the displayed "Setting" or data processing function

3 NO
Returns to the previous screen without accepting any changes

4 OK
Accepts changes made

5 Show
Shows the sound level meter's "Settings"

6 Pause/Cont.
Pauses the current measurement or, if paused, continues it without resetting

7 Reset
Resets the buffer to zero. Preceded by a warning if the elapsed time is over 1 minute. Resets all (Log, Memory, Buffer) to zero if held down together with **Data**

8 Level ▲ and ▼
Selects the level of the measurement range in 10dB steps. Resets the sound level meter (if "Range Change with Reset" selected). In Edit mode, moves the cursor on the display)

9 Frequency Wt. ▲ and ▼
Selects the frequency weighting of the RMS signal (A, C, L or 1/1-octave bandwidth*). Resets the sound level meter

10 Parameter ▲ and ▼
Selects the displayed parameter (L_{eq}, SPL, MaxL, etc.). Selects the parameter in the sound level meter's "Settings" and data processing functions

11 F/S/I
Selects the time weighting. Resets the sound level meter

12 Data
Prints, stores, recalls and erases results from the memories (Buffer, Log, Memory)

13 Light
Turns the display's back-light on or off (the back-light automatically switches off 30s after the last pushkey has been pressed)

Display

14 Range
80dB RMS measurement range

15 Quasi-analogue Display
Instantaneous SPL between the range limits. Updated 32 times per second

16 +
Overload occurring: the signal exceeds the measurement range

17 Filter Centre Frequency*
Current filter centre frequency (if selected).

18 Battery Low Warning
Battery voltage < 4V. Approximately 1/2 hour's operation left

19 OVL
Overload has occurred since last reset

20 PAUSE
In Pause mode. No results being added to the buffer or the log

21 Elapsed Time
Elapsed time of current measurement since last reset

22 F/S/I
Current time weighting

23 Parameter and Level
Level of the displayed parameter updated every second

24 dBA/C/L
Current frequency weighting of the RMS (or Peak) signal if a RMS (or Peak) parameter is displayed. Weighting not shown if 1/1-octave bandwidth selected*

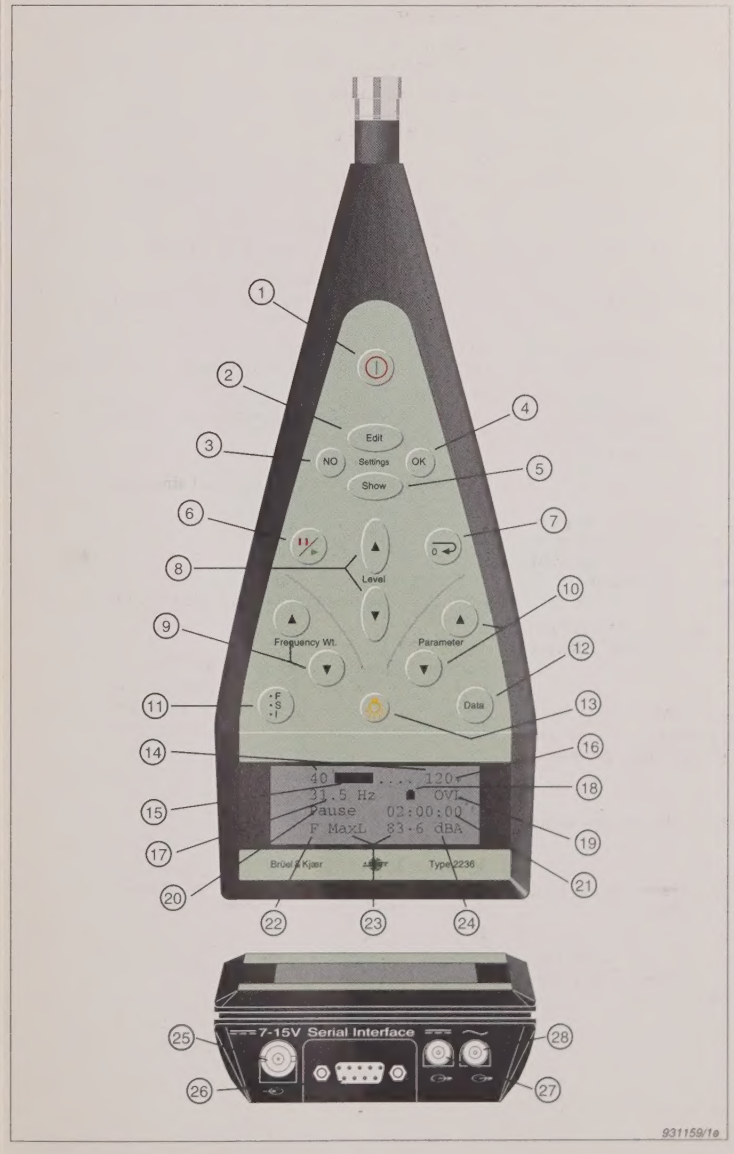
Sockets

25 External Power
Socket for external 7–15V DC supply

26 Serial Interface
9-pole male serial interface socket for transfer of data to printers and computers

27 DC Output
LEMO socket for recording of weighted SPL on level recorder or similar

28 AC Output
LEMO socket for transfer of signal from preamplifier directly to DAT-recorder or similar



* Only available with filter set versions (Types 2236 C–007 and 2236 D–007)

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